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MASTER OF MILITARY STUDIES

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Abstract
Air Reconnaissance is the acquisition of intelligence information by employing visual observation and/or sensors in air vehicles. Joint Pub 1-02, Department of Defense (DOD) Dictionary of Military and Associated Terms. It supports the intelligence warfighting function and is employed strategically, operationally, and tactically. Air reconnaissance is aviations oldest mission area, dating back to the use of balloons to observe the adversary during the French Revolution. One of the first missions of the airplane was observation. Today, the means of observing are dramatically different from the days of the eyeball sensor. Sophisticated air reconnaissance sensor systems play a critical role in planning and executing military operations. Marine air reconnaissance assets collect information concerning the terrain, weather, hydrography, and enemy situation in areas of operations to provide commanders with real-time or near-real-time information. The proper use of manned and unmanned air reconnaissance assets enables commanders within the MAGTF to maximize their forces effectiveness by optimizing friendly strengths and exploiting enemy critical vulnerabilities.

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SHOULD INCLUDE THE FOREGOING STATEMENT.

Air Reconnaissance

U.S. Marine Corps

DEPARTMENT OF THE NAVY
Headquarters United States Marine Corps
Washington, DC 20380-1775

FOREWORD

Air Reconnaissance is the acquisition of intelligence information by employing visual observation and/or sensors in air vehicles. Joint Pub 1-02, *Department of Defense (DOD) Dictionary of Military and Associated Terms.* It supports the intelligence warfighting function and is employed strategically, operationally, and tactically.

Air reconnaissance is aviation's oldest mission area, dating back to the use of balloons to observe the adversary during the French Revolution. One of the first missions of the airplane was observation. Today, the means of observing are dramatically different from the days of the "eyeball" sensor. Sophisticated air reconnaissance sensor systems play a critical role in planning and executing military operations. Marine air reconnaissance assets collect information concerning the terrain, weather, hydrography, and enemy situation in areas of operations to provide commanders with real-time or near-real-time information. The proper use of manned and unmanned air reconnaissance assets enables commanders within the MAGTF to maximize their force's effectiveness by optimizing friendly strengths and exploiting enemy critical vulnerabilities.

Marine Corps Warfighting Publication (MCWP) 3-26, *Air Reconnaissance*, addresses basic air reconnaissance tactics, techniques, and procedures (TTP) for planning and execution. Intended for commanders and their staffs; as well as, aircrews, operators, and controllers, MCWP 3-26 highlights the following:

- The role of air reconnaissance in Marine aviation
- Command, control, and communications
- Planning
- Execution
- Air reconnaissance in emerging concepts and capabilities

MCWP 3-26 provides the requisite information needed by commanders and staffs to understand and evaluate the operational principles and capabilities of Marine air reconnaissance.

This publication supersedes Fleet Marine Force Manual (FMFM) 5-10, *Air Reconnaissance*.

Recommendations for improving this publication are invited from commands as well as directly from individuals.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

B. B. KNUTSON, JR
Lieutenant General, U.S. Marine Corps
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27 Feb 2001

From: Major Major Robert L. Rauenhorst and Lex A. Brown
To: Dr. John Mathews

Subj: **MEMORANDUM FOR THE RECORD**

In order to meet the Master of Military Studies Requirements for the Degree, Major Rauenhorst and Major Brown worked in coordination to develop Marine Corps Warfighting Publication (MCWP) 3-26, *Air Reconnaissance*, for their thesis. MCWP 3-26 provides the requisite information needed by commanders and staffs to understand the capabilities of Marine air reconnaissance in planning and executing operations.

MCWP 3-26 is designed to supersede Fleet Marine Force Manual (FMFM) 5-10, *Air Reconnaissance*. In liaison with Doctrine Division, Marine Corps Combat Development Command, this publication will be submitted to replace FMFM 5-10 as Marine Corps doctrine. The development of the publication could not have been achieved without the support received from MAWTS-1, MAG-31, and other subject matter experts in the Fleet Marine Force.

Major Robert L. Rauenhorst

Major Lex A. Brown

Air Reconnaissance

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Chapter 1

The Role of Air Reconnaissance in Marine Aviation

"All warfare is based on deception. If I am able to determine the enemy's disposition while at the same time I conceal my own then I can concentrate and he must divide."

Sun Tzu

HISTORICAL EVOLUTION

In 1793 the French added the balloon to its military forces creating an air arm to its capabilities. During a battle in 1794, the French air commander ascended in a balloon to view enemy movement. The commander's observations permitted French forces to achieve the decisive action in winning the battle. France became an advocate of air reconnaissance and deployed balloons to Italy in 1797 and to Egypt in 1798 for air observation missions.

The United States first used military air reconnaissance during the Civil War. Also during this period, ballooning was used to adjust artillery fire and for direct link air-to-ground communications.

The Russians, during the Russo-Japanese War of 1905, conducted the first successful air photographic reconnaissance. The introduction of fixed wing aircraft dramatically improved the range and mobility of air reconnaissance. The original use of fixed wing military aviation was to perform both visual and photographic reconnaissance. Six years later, in 1911, the U.S. Army successfully took the first photographs from a powered aircraft.

As World War II approached, improved air reconnaissance methods played an important part in the Allied victory. These methods included night photography, longer focal length lenses, and infrared imagery. The concept of slow flying aircraft or refitted bombers used as reconnaissance aircraft was stopped in favor of smaller, faster, and more agile aircraft. Air reconnaissance aircraft had to out perform the enemy's fastest fighters to survive. The Marine Corps began modifying existing airframes like the F6F *"Hellcat"* to collect photos, and for the first time formed specialized reconnaissance and observation squadrons. Besides photo reconnaissance squadrons, observation squadrons were commissioned to provide direct visual reconnaissance and artillery adjustment for Marine ground forces. Flying OY-1 *"Birddog's"*, VMO-1, 2, 4, and 6 participated in the Saipan, Tinian, and Okinawan campaigns.

In Korea, the Marine Corps used F2H-2P *"Banshees"* to collect photos. Photographs taken before the landing at Inchon enabled photo interpreters to predict the high tide at Inchon's 15-foot seawall and to plan the assault. Once again, slower platforms like the OY-1 were used in the observation role,

reconnoitering avenues of approach and spotting artillery. Korea also marked the first use of trained aircrew, the Naval Aerial Observer (NAO), to enhance the Air-Ground team.

In Vietnam, air reconnaissance allowed planners to predict major offensives, track and attack moving supplies, and target specific strategic locations. The development and employment of surface-to-air missiles (SAM's) brought new obstacles to air reconnaissance and a reevaluation of tactics and equipment. During this time Marine air reconnaissance continued to utilize specialized squadrons and aircraft. RF-8 *"Crusaders"* took the photoreconnaissance role, and the *"Birddog's"* were replaced by an aircraft specially designed to conduct counterinsurgency operations, the OV-10 *"Bronco."*

Since the mid-1970's, U.S. military services have been discarding their dedicated tactical reconnaissance aircraft and relying on national and theater assets to provide air reconnaissance information. The Navy first gave up the RA-5 *"Vigilante"* and then the RF-8. In August 1990, VMFP-3 stood down and the Marine Corps sent its last dedicated manned tactical imaging air reconnaissance platform, the RF-4 *"Phantom"*, to the bone yard. The Air Force likewise phased out its SR-71 *"Blackbirds"* and RF-4's.

During Desert Shield and Desert Storm the Marine Corps relied on, and competed with, other services and agencies to fill the gap for air reconnaissance needs. The Marine Corps was forced upon the mercy of national and other theater assets for good quality imagery. These agencies were themselves saturated with requests and generally were unable to get imagery products to the force in less than 72 hours. When the imagery did arrive, the Marine intelligence analysts were disappointed in the quality; they were getting third- and fourth-generation copies. At first, the force's principal organic systems for battle damage assessment (BDA) within southeastern Kuwait were RQ-2A, *"Pioneer,"* remotely piloted unmanned air vehicles (UAV's) and OV-10's. The *"Pioneer"* provided real-time imaging, although it was of grainy quality. The OV-10 employed its forward-looking infrared (FLIR) for night observation, but was vulnerable to visually fired surface-to-air heat–seeking missiles during daylight. There were very few organic air reconnaissance assets available to provide quality air reconnaissance information to the operating forces. Therefore, BDA was often delayed, which in turn stretched out the targeting process. Sometimes the delays resulted in targets being unnecessarily struck a second time. Other aerial assets arrived in-theater to fill the gap, including Marine F/A-18D *"Hornets"*. The F/A-18D's provided a limited air reconnaissance capability during the air and ground campaign in an attempt to ease the burden on Marine forces.

After Desert Storm, the Marine Corps retired its last three observation squadrons, and for the first time in 80 years found itself without an organic, manned, air reconnaissance platform. Throughout the 1990's the Marine Corps' primary organic tactical air reconnaissance platform has been the *"Pioneer."* During Operation Allied Force in 1999, F/A-18D's equipped with advanced tactical airborne reconnaissance systems (ATARS) performed a limited number of air reconnaissance missions over Kosovo in support of Coalition forces. This is the first time since the retirement of the RF-4 that the Marine Corps has possessed an organic, manned, imagery, air reconnaissance platform. With the incorporation of the ATARS equipped F/A-18D's to complement the *"Pioneer"* UAV, Marine air

reconnaissance is more responsive to a wide spectrum of end users, from infantryman securing a hill to aircrew delivering ordnance.

With air reconnaissance platforms that are able to acquire and transmit air reconnaissance information real-time and near-real-time, technological systems in the Marine Corps need to permit the rapid dissemination of intelligence products to commanders. The tactical exploitation group (TEG), squadron ground station (SGS), tactical electronics reconnaissance processing and evaluation system (TERPES), mission planning and control station (MPCS), and remote video terminal (RVT) are systems organic within the MAGTF in which Marines are able to rapidly disseminate and acquire air reconnaissance information.

AIR RECONNAISSANCE IN MAGTF OPERATIONS

Marine aviation provides the MAGTF six functional areas: offensive air support (OAS), antiair warfare (AAW), assault support, air reconnaissance, electronic warfare, and control of aircraft and missiles. Air reconnaissance is the acquisition of intelligence information by employing visual observation and/or sensors in air vehicles. (Joint Pub 1-02)

As one of the six functions of Marine aviation, air reconnaissance is an essential warfighting tool for the MAGTF. Air reconnaissance provides raw intelligence information to commanders and decision-makers at all levels. This raw intelligence information is then converted into useful intelligence information to reduce uncertainties in planning and executing MAGTF operations. To be effective, air reconnaissance must be responsive, flexible, survivable, and produce imagery products in all weather conditions. The MAGTF commander focuses intelligence and supporting air reconnaissance efforts through articulation of his intent, planning guidance, and intelligence requirements (IR's). MAGTF IR's drive intelligence collection, production, and dissemination activities.

FUNCTIONS

As one of the six functions of Marine aviation, the aviation combat element (ACE) should be prepared to conduct air reconnaissance in support of the MAGTF. In addition, every Marine aircrew planning for or flying a sortie on the air tasking order (ATO) needs to be cognizant of the unique position they are in to observe and report high value information in support of MAGTF operations.

Air reconnaissance primarily supports the intelligence warfighting function; however, it also provides significant contributions to command and control, maneuver, fires, logistics, and force protection warfighting functions. The information derived from air reconnaissance is used to formulate strategy, policy, and military plans; to develop and conduct campaigns; and to carry out military operations. Marine Corps air reconnaissance assets are tactical in nature, but they can be used to gather information to meet these requirements at all levels of warfare. Air reconnaissance supports strategic, operational, and tactical operations by providing information and services to a divergent set of customers, ranging from national to unit-level decision makers.

- **Strategic.**   Strategic air reconnaissance provides intelligence information required for the formulation of plans and policies at the national and international level. Strategic air reconnaissance operations:

    - Identify enemy centers of gravity and strategic targets.
    - Warn of hostile intent and actions.
    - Analyze enemy deployment and employment.
    - Assess damage to enemy and friendly targets.
    - Determine enemy force structure.
    - Identify the enemy's electronic order of battle (EOB).

- **Operational.** Operational-level air reconnaissance provides the information crucial to planning and executing theater-wide operations that help accomplish the MAGTF commander's or joint force commander's (JFC's) objectives. Operational air reconnaissance operations:

    - Provide the intelligence information crucial to understanding an adversary's weaknesses and key nodes that can be effected by friendly forces in developing courses of action (COA's).
    - Helps define the critical vulnerabilities of an enemy's national structure and military capabilities.
    - Provides information on terrain, weather, and the enemy's size, movement, and situation.
    - Threat assessment.
    - Identify targets.

- **Tactical.** Air reconnaissance supports the tactical level of operations and is primarily focused on the following:

    - Tactical threat warning.
    - Mission planning.
    - Targeting.
    - Combat assessment (CA).
    - Threat assessment.
    - Target imagery.
    - Artillery and naval gunfire adjustment.
    - Observation of ground battle areas, targets, or sections of airspace.

CATEGORIES

The MAGTF's aviation assets can provide three types of air reconnaissance operations and can be employed at the strategic, operational, or tactical levels. The three categories of air reconnaissance operations performed by Marine aviation are visual, imagery, and electronic. See Chapter 4 for more detailed information on the three categories associated with air reconnaissance. A single mission can employ any combination of these three categories.

- **Visual**. Visual reconnaissance acquires current information on enemy activities, resources, installations, weather, and physical characteristics of a given area. It can be conducted by any airborne platform, fixed-wing or rotary-wing, and provides immediate information. Visual reconnaissance is flown in response to specific requests, but all aircrews must be aware of the need to report information when assigned other types of missions. Visual reconnaissance can also be used in supporting the delivery of offensive fires; such as, artillery support and naval surface fire support, and may supplement operational information concerning friendly forces. The limitations of human vision make visual reconnaissance susceptible to enemy cover, concealment, and deception techniques.

- **Imagery.** Imagery reconnaissance is used to detect and pinpoint the location of enemy installations, facilities, and concentrations of forces and is also used to support terrain analysis. Imagery is recorded from a sensor device that can include the aircraft's cameras, radar, infrared devices, and other collateral equipment found in or on the aircraft. The Marine Corps relies on a complementary mix of tactical, theater, and national reconnaissance assets to support its collection of imagery for planning and executing operations. Imagery can be classified as optical or non-optical.

  - **Optical.** Optical imagery is captured by focusing light on an image sensor using lenses, similar to a commercial still or video camera. Optical imagery is unmatched for its resolution and has the primary benefit in that it produces images that are easily interpreted by the customer. However, optical images require their targets to be illuminated to some extent by visible light and also require an unobstructed view at their target without interference from clouds or physical obstructions. Optical sensors include 35 mm and digital handheld cameras, heads-up display (HUD), and electro-optical sensors.

  - **Non-optical.** Infrared (IR) and radar sensors capture non-optical imagery. Unlike optical sensors, these non-optical sensors function regardless of the presence or absence of visible light and can be used at night as well as during the day. IR sensors can distinguish thermal differences between objects on the battlefield. Because of this capability, IR sensors have specific capabilities during times of darkness and during certain types of weather. IR sensors due have limitations from battlefield obscurants and cannot image through overcast weather decks. Radar is the second type of non-optical sensor and uses recorded radar returns to produce images. Radar is independent of light conditions and is practically independent of weather conditions, making it a true all-weather sensor.

- **Electronic**.   Electronic reconnaissance detects, locates, identifies, and evaluates enemy electromagnetic radiation.   Electronic reconnaissance is performed with passive interception equipment that recovers signals and determines signal direction, source, and characteristics.   It gathers data that, when processed into intelligence, is used to update the electronic order of battle and technical intelligence. This is valuable when the enemy uses electronic means for fire control, navigation, communication, and air surveillance. By analyzing the enemy's communications and radar emissions, analysts identify an enemy's electronic order of battle and critical nodes to include enemy command posts, high-threat weapon systems, force concentrations, and logistic bases. Most types of aircraft are equipped with radar warning receivers (RWR) systems that can provide crude electronic reconnaissance information, even though it may only be a direction of arrival from the enemy's radar.

MAGTF ORGANIC AIR RECONNAISSANCE ASSETS

Air reconnaissance provides the MAGTF commander with a rapid means of acquiring visual, imagery, and electronic information on enemy activity, installations, and terrain. In order to collect information in all three categories of air reconnaissance, Marine aviation squadrons are task organized to support MAGTF air reconnaissance requirements.   While the Marine Unmanned Aerial Vehicle Squadron (VMU) is the only truly dedicated air reconnaissance squadron within the MAGTF; multi-mission capable squadrons such as HMLA, VMFA(AW), and VMAQ, are equipped and trained to perform specific air reconnaissance operations. See MCWP 3-2, *Aviation Operations,* and chapter 4 and appendix A of MCWP 3-26 for more information on specific air reconnaissance missions and tasks assigned to Marine aviation squadrons.

In addition to the squadrons primarily dedicated to air reconnaissance, other aircraft organic to the MAGTF have, through adaptive techniques, been able to use systems and weapons to provide imagery and information to the ground commander. Marine aviation squadrons are specifically designed to be multi-mission capable and provide air reconnaissance information in general support of the MAGTF. All Marine aircraft units constantly perform visual reconnaissance and are capable of obtaining imagery through use of handheld cameras.   They also possess the capability to provide crude electronic reconnaissance through the use of onboard radar warning receivers.   Based on their equipment capabilities and the situation, the ACE can provide air reconnaissance platforms equipped with sensors to conduct missions other than visual reconnaissance. A passing strike aircraft, airborne forward air controller, escort aircraft, or dedicated reconnaissance aircraft can provide timely air reconnaissance information. See chapter 4 and appendix B for more information on types of Marine aircraft, sensors, and weapons that are capable of providing air reconnaissance information.

NON-ORGANIC AIR RECONNAISSANCE ASSETS IN SUPPORT OF THE MAGTF

The Marine Corps relies on a complementary mix of tactical, theater, and national air reconnaissance sources to support its intelligence, planning, deployment, and operational phases. The MAGTF G-2/S-2 and G-3/S-3 are responsible for requesting the full range of U.S. air reconnaissance information in support of the assigned mission. Due to the nature of expeditionary operations, the employment of organic MAGTF air reconnaissance assets within the assigned area of operations is generally not feasible until just prior to the actual introduction of forces. This means that national or theater intelligence assets must be relied upon for pre-deployment air reconnaissance support. Even when MAGTF air reconnaissance assets are employed, the MAGTF G-2/S-2 and G-3/S-3 will continue to require national and theater support in specific areas to add depth to the air reconnaissance effort and cover gaps in organic collection capabilities. Appendix C lists some of the national and theater platforms that may support the MAGTF in providing air reconnaissance information. See MCWP 2-11, *MAGTF Intelligence Collection Plans*, for more information on requesting air reconnaissance in support of the MAGTF.

PREREQUISITES FOR EFFECTIVE AIR RECONNAISSANCE

Effective air reconnaissance planning and execution revolve around a few basic prerequisites to achieve desired mission results. When any one or any combination of these prerequisites are omitted, air reconnaissance may not be as *effective*. For example, an air reconnaissance aircraft may be shot down or may miss the target due to our inability to suppress the enemy's air defenses. The ACE may be conducting air reconnaissance, but at what risk or to what effect? The requirements for effective air reconnaissance are as follows:

- **Air superiority**. In order to attain air superiority, efforts must be made to create an operating area that allows air reconnaissance aircraft to prosecute targets without prohibitive interference from enemy fighter aircraft. This can be achieved by conducting an aggressive antiair warfare (AAW) campaign prior to conducting air reconnaissance or by tasking aircraft as fighter escort during air reconnaissance operations. It is imperative that the GCE understand why air superiority is important. If the enemy can interfere with our air reconnaissance aircraft by launching fighters, then they can prohibit or disrupt our access to air reconnaissance information required to support the MAGTF.

- **Suppression of enemy air defense (SEAD)**. Suppression of enemy air defenses is important in that it can create a "vertical or lateral sanctuary" that enables air reconnaissance aircraft to concentrate on collecting reconnaissance information on targets vice self-protection. Traditionally, the perception of SEAD responsibilities have fallen upon artillery. While artillery is well suited in this role, ACE planners must plan for SEAD requirements when indirect fire assets may not be available; i.e., air reconnaissance missions beyond the range of organic artillery and mortars. High-speed anti-radiation missiles (HARM's), imbedded suppression, and jamming (EA-6B) should all be considered when addressing the SEAD effort.

- **Cooperative weather**. The greatest air reconnaissance plan can be executed, and you can still experience prohibitive interference or unacceptable attrition if low ceilings force air reconnaissance platforms to acquire targets "under the weather".   From 1950 to the present, 85% of all aircraft combat attrition can be directly attributed to AAA. Air reconnaissance platforms forced to low altitude are in the heart of the AAA envelope. Inclement weather can negatively influence more than friendly attrition. Target acquisition and sensor performance can all be affected by inclement weather. As a planner, you must look at your available air reconnaissance platforms and sensors, be knowledgeable of their capabilities and limitations, and optimize the way in which you employ them.

- **Capable platforms/sensors**. To increase the probability for successful target acquisition, the air reconnaissance platform needs to be technologically advanced. Historically, the most difficult task associated with the majority of Marine air reconnaissance missions, has been target acquisition. Our air reconnaissance platforms need accurate reconnaissance systems and sensor equipment to aid in target acquisition during day and night operations. These new systems include Night Targeting FLIR's, ATARS, Generation III Night Vision Devices (NVD's), and Synthetic Aperture Radar (SAR). See appendix B for air reconnaissance platforms and sensors capabilities guide.

- **Flexible control**. A responsive command, control, and communication (C3) system is required to ensure that proper air reconnaissance customers get what they need and when they need it. The increased situational awareness will yield great dividends. Positive information flow, both up the chain of command and down the chain of command, with a simple and redundant back-up plan is the key to successful control.

- **Prompt response**. Air reconnaissance must be timely to be successful. The techniques available to reduce response time can be grouped into three categories; basing posture, alert status, and mission classification.

  - **Forward basing.** By forward basing you reduce the transit time to and from the battlespace, and also allow air reconnaissance platforms more time on station. Forward basing will, however, incur both logistical and security requirements.

  - **Alert status.** This is a *"queuing"* system that directs air reconnaissance platforms to be able to take-off in 60, 30, 15, or 5 minutes. As the C3 system receives requests for air reconnaissance, the alert status can be upgraded to provide air reconnaissance as required by battlespace conditions. Airborne alerts may be utilized, however this may represent the fastest response time but also potentially reduces the economy of force while increasing the wear on assets.

  - **Mission classification.** The classification of the air reconnaissance mission directly impacts the timeliness of the support. To request air reconnaissance missions, units submit a joint tactical air reconnaissance/surveillance request (JTAR/SR) via the units intelligence section for preplanned missions and the direct air support center (DASC) for immediate missions. See

MCWP 2-11, *MAGTF Intelligence Collection Plans*, and MCWP 3-25.5, *Direct Air Support Center Handbook*, for more information on requesting air reconnaissance support. See appendix D for a sample JTAR/SR. Preplanned air reconnaissance missions are in accordance with a program and planned in advance of operations. Preplanned missions are either scheduled or on-call. Immediate missions meet requests that arise during battle and are generally urgent in nature.

- **Preplanned Scheduled Missions** are executed at a specific time against a known location or area. Air reconnaissance sensors and weapons load plans, flight compositions, and flight profiles are optimized to maximize mission success. Scheduled missions can be either dedicated or integrated.

    - **Dedicated missions** are focused solely on collecting air reconnaissance information.

    - **Integrated missions** increase the efficiency of aviation assets by tasking multi-role capable aircraft to collect air reconnaissance information while performing other missions. For example, an F/A-18D equipped with ATARS may be tasked to obtain imagery on a named area of interest (NAI) in the MAGTF's close battlespace enroute on a DAS mission to strike a target in the MAGTF's deep battlespace.

- **Preplanned On-call Missions** involve aircraft that are preloaded for a particular air reconnaissance mission and placed in an appropriate ground/airborne alert status. Aircrews can conduct mission planning based on the information that is available, but not to the same detail of a scheduled mission. On-call missions allow the requesting commander to employ air reconnaissance assets as the tactical requirement arises based on prior mission analysis.

- **Immediate Missions** cannot be identified far enough in advance to permit detailed mission coordination and planning. Air reconnaissance assets may be on ground alert or diverted from other missions via the Marine air command and control system (MACCS) to execute immediate requests. Although the aircraft may not be carrying the optimum sensor load, a quick visual or sensor air reconnaissance of the area may provide critical information to exploit an unexpected enemy weakness or maintain the momentum of an attack. Immediate mission response times will vary based on the distance from the area that the asset was launched or diverted.

By adhering to four simple principles, air reconnaissance personnel can maximize intelligence support to the consumers. These key principles are discussed below.

- **Integration.** Air reconnaissance operations and the intelligence process must be fully integrated to meet the timeliness and accuracy requirements of MAGTF operations. The commander considers both the capabilities and limitations of air reconnaissance systems and organizations in the decision-making, planning, preparation, execution, and assessment processes. Similarly, personnel must be

fully aware of mission goals and objectives and integrating air reconnaissance into the operational environment, at all levels.

- **Accuracy.** To best support MAGTF operations, air reconnaissance derived products must be as accurate as possible. Accuracy implies reliability and precision. This requires corroboration and analysis of all information. Extensive knowledge of adversary strategy, tactics, capabilities, and culture enables personnel to anticipate actions and provide the most complete and exact picture possible to planners and operators. Accuracy also aids commanders in defeating adversary deception efforts. Geoposition accuracy is a crucial requirement for target acquisition, especially with the employment of global positioning system (GPS) guided munitions. Sensors acquire information that enables targeteers to produce target locations or aim points suitable for the accurate employment of these types of weapon systems. Lastly, one of the most demanding tasks for air reconnaissance personnel during emerging crises is the need to balance requirements for accuracy with responsiveness. Judging the appropriate balance between accuracy and expediency requires very close coordination with operations planners.

- **Relevance.** Relevance in air reconnaissance means that the air reconnaissance product is tailored to the MAGTF commander's needs. Intelligence information and collection requirements should directly apply to determining, planning, conducting, and evaluating operations. Air reconnaissance derived information should focus on the command's potential, planned, and ongoing courses of action (COA's). Part of insuring the relevance of intelligence to the warfighter means air reconnaissance planners must consider the suitability of specific reconnaissance assets to achieve the commander's objectives. Planning the employment of reconnaissance assets is based on an asset's capability and its suitability, within the context of the overall collection plan, to meet user requirements. Suitability also applies to the format of the processed intelligence. Both the information and the format must be useful to the user.

- **Timeliness.** Air reconnaissance products must be available in time to plan and execute operations as required. This principle applies to identifying and stating requirements, collecting information, and producing 'actionable' intelligence. Old intelligence is history. Timely intelligence is essential to prevent the use of surprise by the adversary, conduct defense, seize the initiative, and use forces effectively. The dynamic nature of air reconnaissance can provide information to aid in a commander's decision-making cycle and constantly improve the commander's view of the battlespace. The responsive nature of Marine air reconnaissance assets is an essential enabler of timeliness. Collected information is disseminated to the appropriate processing agency or user based on established collection or reporting requirements. However, since air reconnaissance assets in the MAGTF are limited, the commander's objectives and priorities often drive responsiveness. Commanders examine the range of missions to be accomplished and ensure appropriate and sufficient reconnaissance assets are available. Finally, ensuring communication connectivity throughout the air reconnaissance "system" is the key to delivering timely intelligence to consumers.

SUMMARY

Marine air reconnaissance employs visual observation and/or sensors in aerial vehicles to acquire intelligence information. While the MAGTF's air reconnaissance assets are tactical in nature, they can be tasked to collect information to satisfy intelligence requirements at the strategic and operational levels of warfare. The MAGTF may require non-organic air reconnaissance assets to fill the gap for air reconnaissance information due to organic capabilities and operational requirements. Air reconnaissance primarily supports the intelligence warfighting function and is critical in planning and executing MAGTF operations.

Aviation assets organic to the MAGTF perform the three types of air reconnaissance operations: visual, imagery, and electronic reconnaissance. The intelligence information derived from air reconnaissance supports the MAGTF commander's decision-making process by reducing the uncertainties in the battlespace. The success of air reconnaissance operations requires effective planning and execution to include: air superiority, suppression of enemy air defenses, favorable weather, capable platforms/sensors, flexible control, prompt response, forward basing, alert states, and mission classification. To be responsive, air reconnaissance must adhere to the basic principles of integration, accuracy, relevance, and timeliness.

Chapter 2

Command, Control, and Communications

"Whoever, can make and implement his decisions consistently faster gains a tremendous, often decisive advantage. Decisionmaking thus becomes a time-competitive process, and timeliness of decisions becomes essential to generating tempo. "

MCDP 1, *Warfighting*

In air reconnaissance operations, as with all MAGTF operations, the command, control, and communications (C3) system builds a comprehensive picture of the battlespace. The principal objectives of the MACCS are to enhance unity of effort, integrate elements of the command and control system, and help maintain the commander's situational awareness. From this situational awareness, commanders and operators involved in the planning and execution of air reconnaissance operations are able to make decisions regarding the actions needed to force the enemy to do our will. This chapter will review command and control methods, measures, and resources, used to facilitate the MAGTF and ACE commander, as well as the MAGTF G-2/S-2, in making decisions needed for the effective and efficient conduct of air reconnaissance operations.

Critical to the success of any military operation is the commander's ability to make accurate tactical decisions more quickly than the enemy. Because commanders can not be physically present over all the battlespace, they must rely on communication channels to relay their intent, gather information, and influence the battle.

COMMAND

The MAGTF is a balanced, air-ground combined arms task organization of Marine Corps forces under a single commander, structured to accomplish a specific mission. It is the Marine Corps' principal organization for all missions across the range of military operations. The MAGTF commander is the individual responsible for the conduct and operations of all forces under his command. All MAGTF's are task-organized and vary in size and capability according to the assigned mission, threat, and battlespace environment. They are by design, expeditionary, and comprised of four core elements: a command element, a ground combat element, an aviation combat element, and a combat service support element.

The ACE commander is responsible for the conduct of air reconnaissance operations to meet MAGTF collection and operational requirements. Other element commanders provide support to the ACE commander in the form of planning, resources, and logistics that are necessary to conduct air reconnaissance operations. The involvement of all element commanders in planning and conducting air reconnaissance operations are necessary to lend unity of effort to the MAGTF.

The ACE commander normally delegates authority for the detailed planning and execution of air reconnaissance operations through the MACCS. From the command post at the tactical air command center (TACC), the ACE commander, or his designated authority, provides centralized command and control over the execution of air reconnaissance operations.

CONTROL

A unique relationship exists between the MAGTF and ACE commander in regards to who controls Marine air reconnaissance assets. Because air reconnaissance assets can be utilized for both operational and intelligence support within the MAGTF's area of operations (AO), the MAGTF commander must make an apportionment decision to identify the total level of air reconnaissance that should be dedicated to accomplish the mission. The MAGTF's G-2/S-2, G-3/S-3, and major subordinate commanders provide recommendations to the MAGTF commander for apportionment decisions and the employment of air reconnaissance to support the war fighting functions.

The ACE commander exercises command and control via the Marine air command and control system (see MCWP 3-25, Control of Aircraft and missiles). Air operations (flight tasking, airspace deconfliction, etc.) are planned, coordinated, and controlled by the ACE G-3/S-3 via the tactical air command center (TACC). Intelligence collection requirements, however, are designated by the MAGTF, and require close coordination between the MEF intelligence battalion's intelligence operations center (IOC) and the TACC. To assist with UAV mission planning and execution, VMU will generally provide a task-organized team to the IOC, which will typically operate from within the surveillance and reconnaissance cell (SARC). It is important to note here that the IOC is not always in close proximity or co-located with the TACC.

The ACE, MAGTF G-2/S-2, or MAGTF G-3/S-3 doesn't own the UAV, the MAGTF commander does. Once the VMU becomes operational, the ACE loses control of the UAV while it still retains responsibility to man, equip, and train the VMU. The ACE commander does retain overall operational control (OPCON) of VMAQ, VMFA(AW), HMLA, and other squadrons organic to the MAGTF.

Varying degrees of control and operations can exist within air reconnaissance and are dependent on each particular situation. The MAGTF commander's guidance establishes precise guidelines for control. The MACCS uses air direction and air control for air reconnaissance aircraft within the MAGTF's area of operations (AO).

Air direction is the authority to regulate the employment of air resources. It balances an air resource's availability against its assigned priorities and missions.

Air control is the authority to direct the physical maneuvering of aircraft in flight or to direct an aircraft to engage a specific target. Air control is composed of airspace control and terminal control.

• **Airspace control** directs the maneuver of aircraft to use the available airspace effectively. Positive control, procedural control, or a combination of positive and procedural control is used when conducting air reconnaissance operations.

• **Terminal control** directs the delivery of artillery and Naval gunfire support through air observation by air reconnaissance aircraft.

MARINE AIR COMMAND AND CONTROL SYSTEM

The ACE commander uses the MACCS to plan and direct air operations and to employ aviation assets in a responsive, timely, and effective manner. The MACCS provides the ability to exercise centralized command and decentralized control of MAGTF air assets and operations. The MACCS is the command and control (C2) system which provides the ACE commander the means to command, coordinate, and control all air operations within an assigned sector as directed by the MAGTF commander, and allows interface of MAGTF air with joint or combined operations (see figure 2-1).

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                          │    MAGTF      │
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                          └──────┬───────┘
                                 │
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                          │    ACE        │
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                          │    TACC       │
                          └──────┬───────┘
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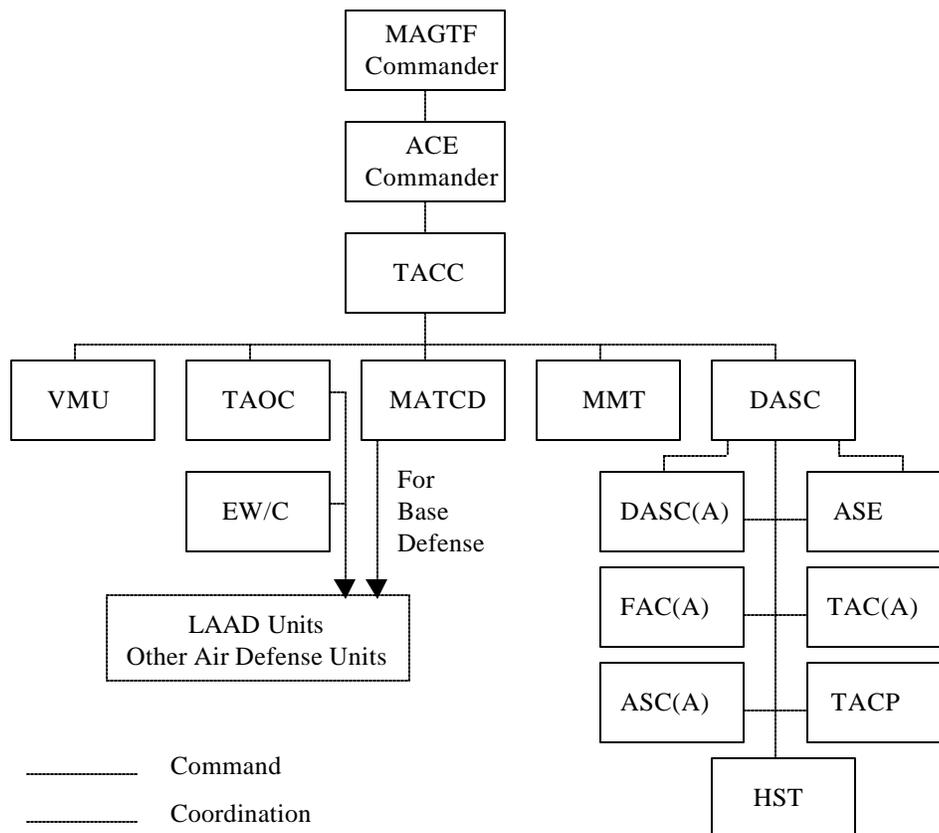
Marine Air Command and Control System Organization
Figure 2-1

The MACCS consists of various air C2 agencies designed to provide the ACE commander with the ability to monitor, supervise, and influence the application of Marine aviation's six functions. The ACE commander uses the MACCS to plan and direct ACE operations. The Marine air control group (MACG) is responsible for providing, operating, and maintaining principal MACCS agencies and VMU.

The ACE commander plans, directs, and coordinates all aspects of aviation employment to exercise centralized command. Decentralized control is the control of aviation assets by MACCS agencies that are responsive to the ACE commander and the dynamic changes in the battlespace. The principal agencies of the MACCS concerned with air reconnaissance are the Marine tactical air command center (TACC), tactical air operations center (TAOC), and the direct air support center (DASC).

Marine Tactical Air Command Center/Tactical Air Direction Center

The Marine TACC is the senior MACCS agency and is the focal point for aviation command and control. It also serves as the operational command post for the ACE commander. Functionally, it is divided into mutually supporting sections: current operations, future operations, future plans, and air combat intelligence. The current operations section executes the current day's air tasking order (ATO) and includes the deep and close battle cells. Typically the TACC will schedule air reconnaissance missions via the ATO. The Marine TACC is capable of functioning as the joint air operations center (JAOC) when the Marine component provides the JFACC.

During amphibious operations, the Marine tactical air command center (TACC) is incrementally phased ashore. Initially, it is a tactical air direction center (TADC), which is subordinate to the Navy tactical air control center (TACC).

The deep and close battle cells are responsible to the ACE commander for the management of all aviation assets assigned to, or available to, the ACE that will be used in the execution of deep and close air reconnaissance operations for the MAGTF. Located in the current operations section of the TACC, the deep and close battle cells will provide the ACE Commander/Senior Watch Officer with the status and results of all deep and close air reconnaissance missions. The deep battle, close battle, and assessment cells may redirect air reconnaissance assets in order to locate time sensitive targets at the discretion of the ACE and MAGTF commanders. During the planning and execution of air reconnaissance missions, the TACC's future and current operations cells ensure appropriate deconfliction and coordination are conducted with surface forces to prevent fratricide. The deep and close battle cells do not control aircraft. They coordinate the necessary routing and provide frequency and contact information to Marine air wings (MAW's), Marine aircraft groups (MAG's), and squadrons for re-tasking or diverting air reconnaissance missions through MACCS agencies. See MCWP 3-25.4, *Tactical Air Command Center*, for a detailed discussion of the TACC.

Tactical Air Operations Center

The TAOC is subordinate to the Marine TACC. The TAOC provides routing, radar control, and surveillance for air reconnaissance aircraft en route to, and from assigned reconnaissance areas. The DASC disseminates air defense control measures received from the TAOC to air reconnaissance aircraft under the DASC's control. The DASC provides friendly aircraft information to the TAOC to assist in aircraft/UAV identification process. See MCWP 3-25.7, *Tactical Air Operations Center Handbook*, for a detailed discussion of the TAOC.

Direct Air Support Center

The DASC is the principal MACCS air control agency responsible for the direction of air operations directly supporting ground forces. It functions in a decentralized mode of operation, but is directly supervised by the Marine tactical air command center (Marine TACC) or the Navy tactical air control center (Navy TACC). During amphibious or expeditionary operations, the DASC is normally the first

MACCS agency ashore and usually lands in the same category; i.e., scheduled or on-call wave, as the ground combat element's (GCE's) senior fire support co-ordination center. The DASC's parent unit is the Marine air support squadron (MASS) of the Marine air control group (MACG).

The DASC processes immediate air support requests; coordinates aircraft employment with other supporting arms; manages terminal control assets supporting GCE and combat service support element forces; and controls assigned aircraft, unmanned aerial vehicles, and itinerant aircraft transiting through DASC controlled airspace. The DASC uses procedural control for aircraft within their airspace. They have no radar and rely on communication networks to pass and relay information. The DASC controls and directs air support activities affecting the GCE commander's focus on close operations and those air missions requiring integration with the ground combat forces (close air support, assault support, and designated air reconnaissance). The DASC does not normally control aircraft conducting deep air support (DAS) and deep air reconnaissance missions as detailed coordination of DAS and deep air reconnaissance missions are not required with ground forces. However, the DASC will provide air reconnaissance information, such as battle damage assessments (BDA's) and in-flight reports (INFLIGHTREP's), from air reconnaissance and offensive air support (OAS) missions to the GCE's senior fire support coordination center (FSCC) when required. A sample INFLIGHTREP is detailed in appendix E.

The DASC controls the UAV's inflight progression/egression to and from assigned reconnaissance areas and monitors its activities while in its working area. The UAV normally enters the airspace control system through the air traffic control (ATC) element at the UAV's operating airfield. After receiving a hand-off from the ATC element, the DASC provides routing and altitude clearance for the UAV. UAV controllers maintain continuous communications with the DASC. The DASC uses airspace control measures to deconflict UAV operations with other aircraft and friendly surface delivered fires. The UAV controllers also supply the DASC with real-time surveillance information. This information is then forwarded to the TACC/FSCC by the DASC for use in the intelligence/targeting effort.

Immediate air support requests sent directly from the requesting unit to the DASC are approved by the FSCC. The joint tactical reconnaissance/surveillance request form is used for requesting air reconnaissance missions. Appendix D contains a sample joint tactical air reconnaissance / surveillance request (JTAR/SR) form.

Upon receiving the request, the DASC will clarify any additional information and assign a request number for reference purposes. The senior FSCC monitoring the tactical air request/helicopter request (TAR/HR) net may approve, disapprove, or modify the request. Normally, the senior FSCC approves the request by remaining silent ("SILENCE IS CONSENT" unless the previous commander's guidance requires positive approval). However, for purposes of confirmation or when doubt concerning the validity of the request exists, the DASC should coordinate with the FSCC's air officer for clarification of the air reconnaissance request. See MCWP 3-25.5, *Direct Air Support Center Handbook*, for more information on the DASC's role in air reconnaissance operations.

The link between the DASC and the senior FSCC is critical for the coordination and integration of the supporting arms capability that air reconnaissance missions provide when they are conducted inside the FSCL. Aircrew can pass visual reconnaissance reports, that are essential to timely battlefield targeting, directly to the DASC which then passes this information to the Marine TACC/TADC and the senior FSCC. The FSCC uses these visual reconnaissance reports in the detect and assessment phases of the targeting cycle.

Doctrinally UAV missions are tasked via a JTAR/SR like any other air reconnaissance asset. The TACC will schedule the UAV via the ATO. Air traffic control (ATC) will coordinate the UAV's launch and recovery, and the DASC will coordinate the mission once the UAV is downrange. The key to UAV tasking is the determination for who has launch and divert authority.

Tasking for a preplanned UAV mission requires a JTAR/SR from the requesting unit to be routed via the MEF G-2/G-3, then to the TACC, and finally to the VMU. Tasking for an immediate UAV mission requires the JTAR/SR from the requesting unit to be routed through the DASC. If the DASC has not been granted launch or divert authority from the TACC, the senior watch officer (SWO) in the TACC retains the launch and divert authority for VMU missions. If the DASC does have the launch or divert authority, then the DASC would directly communicate with the VMU to launch or divert UAV missions. The same rules apply to **all** preplanned and immediate air reconnaissance missions regardless of the air reconnaissance platform.

AIRSPACE CONTROL MEASURES

Airspace control measures increase operational effectiveness. They also increase air reconnaissance effectiveness by ensuring safe, efficient, and flexible use of airspace. Airspace control measures speed the handling of air traffic to and from their assigned air reconnaissance area and minimize the chance of fratricide, and assists air defense units in identifying adversary aircraft or civilian interlopers. Airspace control measures are not mandatory or necessary for all missions.

The airspace control authority is delegated by the JFC or MAGTF commander to assume overall responsibility for the operation of the airspace control system in the area of operations (AO). The MACCS executes the positive and procedural control of aircraft as published by the airspace control authority in the airspace control plan (ACP), airspace control orders (ACO), and special instructions (SPINS). Marine doctrine stresses blending positive and procedural control as appropriate to control its airspace. Where positive control relies on positive identification, tracking, and direction of aircraft within airspace by electronic means, procedural control relies on a combination of previously agreed upon and promulgated orders and procedures (Joint Pub 1-02). These three important control documents are depicted in figure 2-2.
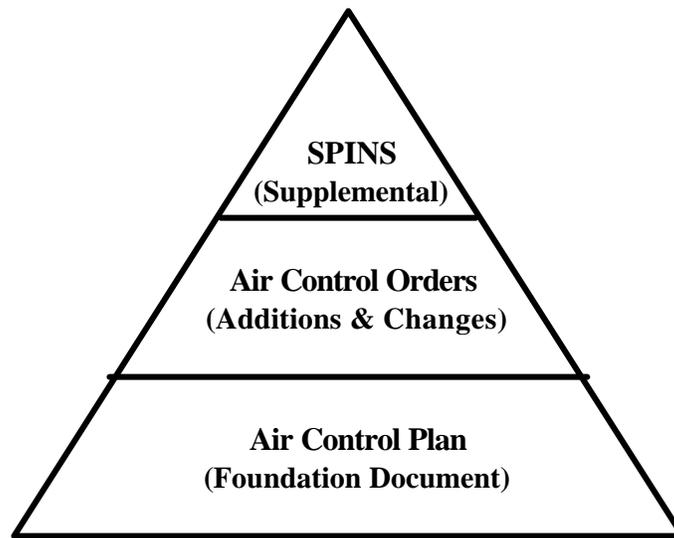
Air Control Documents
Figure 2-2

The airspace control authority develops the airspace control plan (ACP) and, after the JFC/MAGTF commander approval, promulgates it throughout the area of responsibility/joint operations area. Implementation of the ACP is through the airspace control order (ACO), which must be complied with by all components. Special instructions (SPINS) are published in the air tasking order (ATO) and contain information reflecting specific time periods throughout the ATO cycle in which the air control measures identified in the ACP and ACO are to be activated. It can also contain updates to the rules of engagement, standard conventional loads, and identification criteria.

The methods of airspace control vary throughout the range of military operations from war to military operations other than war (MOOTW). The methods range from positive control of all air assets in an airspace control area to procedural control of all such assets, with any effective combination of positive and procedural control measures between the two extremes. See Joint Pub 3-52, *Doctrine for Joint Airspace Control in the Combat Zone*, and MCWP 3-25, *Control of Aircraft and Missiles*, for further discussion on airspace control authority and airspace control planning considerations.

Air reconnaissance aircraft may use formal minimum risk routes (MRR's) and special corridors detailed in the ACO, or use informal routing assigned by the TAOC to transit to and from their target areas. Once inside their assigned reconnaissance area, air reconnaissance aircraft may use procedural control measures detailed in the ACO, such as airspace coordination areas (ACA's), to aid in locating targets, and providing combat assessment (CA). Coordinating altitudes and restricted operating zones (ROZ's) are other types of airspace control measures that aid air reconnaissance aircraft in performing their assigned missions safely and efficiently. UAV mission details listed in the ATO may include their assigned flight plan and reconnaissance areas or routes in which they will be conducting their mission.

This information is required to ensure control agencies and aircraft are given the proper coordinating instructions to ensure deconfliction and situational awareness on UAV missions.

MRR's

MRR's are an airspace control measure used by aircraft primarily when crossing the forward line of own troops (FLOT). These temporary corridors of defined dimensions are recommended for use by UAV's and high-speed, fixed-wing aircraft that present known hazards to low-flying aircraft transiting the combat zone. MRR's are established considering the threat, friendly operations, known restrictions, known fire support locations, and terrain. MRR's also reduce the chance of fratricide between friendly aircraft on return-to-force (RTF) with other friendly aircraft and air defense units. If communications cannot be established, or aircrews are unable to transmit the appropriate identify friend or foe (IFF) signal (lame duck) due to battle damage or system failure, the most non-threatening profile of which the aircraft is capable should be flown. MRR's provide a predictable flight path (ground track, altitude, and airspeed) to aide in the positive identification the aircraft. Depending on the threat's air surveillance capabilities, limiting friendly aircraft to specific MRR's may make friendly aircraft more recognizable and vulnerable to enemy surface-to-air systems. Aircrew intentions should always be broadcast despite the ability to gain and maintain radio contact with friendly force air control agencies. See figure 2-3, airspace control measure.

Fire Support Coordination Line

MRR

Missile Engagement Zone
Crossover Zone
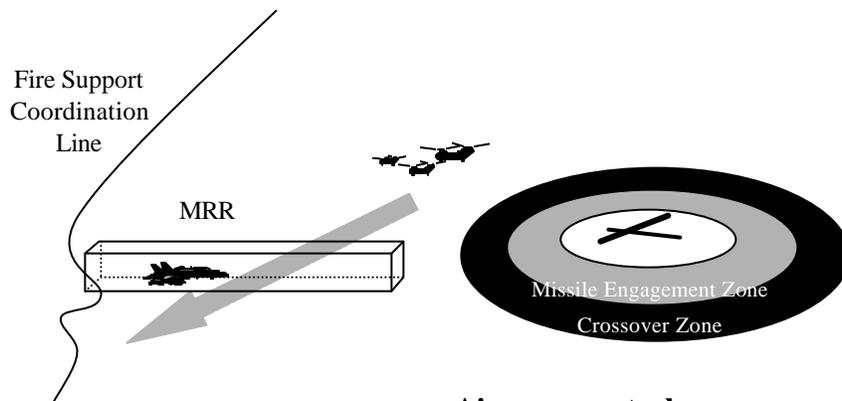
Airspace control measures
Figure 2-3

Special corridors

Special corridors may be in place when air reconnaissance missions require transit over neutral countries not involved in the theater of operations. Special corridors are simply international flight plans that have been approved by the country being overflown to deconflict civilian and military aircraft. These established corridors have defined dimensions as well and should not be confused with MRR's. MRR's are released to friendly forces only via the airspace control plan (ACP) or airspace control order (ACO); where as special corridors are released by civilian aviation authorities. Operation "Deny Flight" is an example where special corridors were used as North Atlantic Treaty Organization (NATO) aircraft transited through Croatian airspace to get to the combat zone.

Informal routing

Informal routing may be generated by the controlling C2 agency and can be used to deconflict specific air reconnaissance missions from other aircraft and fires where a more formal MRR is not required. Informal routes may be listed in the special instructions (SPINS).

Coordinating altitude

Coordinating altitude is a procedural method to separate air reconnaissance aircraft from other fixed-wing and rotary wing aircraft in the battlespace. This method uses an altitude in which fixed-wing aircraft will not fly below or rotary-wing aircraft will not fly above. The coordinating altitude may be specified in the airspace control plan (ACP); however, will more than likely be specified in the special instructions (SPINS) due to the changing search areas for air reconnaissance missions. Coordinating altitudes are typically associated with UAV air reconnaissance missions. See MCWP 3-25, *Control of Aircraft and Missiles*, for more information on coordinating altitudes.

Restricted operations areas (ROA's) and restricted operating zones (ROZ's)

ROA's and ROZ's are synonymous terms for defining a volume of airspace set-aside for specific air reconnaissance missions or requirements. These areas or zones restrict some or all airspace users until termination of the air reconnaissance mission. Typically ROA's and ROZ's will be in effect when UAV missions are in progress. A ROZ may be established at a remote UAV airstrip and the ROA may encompass the UAV's flight path and reconnaissance area. See MCWP 3-25, *Control of Aircraft and Missiles*, for more information on ROA's and ROZ's.

Airspace coordination areas (ACA's)

ACA's provide a universal, joint perspective with which to define specific areas of battlespace, enabling the JFC and component commanders to efficiently coordinate and deconflict air reconnaissance missions. An ACA is a block of airspace in the target area in which friendly aircraft are reasonably safe from friendly surface fires and aircraft. The ACA may be formal or informal. They use lateral, altitude, or timed separation, and act as a safety measure for friendly aircraft while allowing other supporting arms to continue fire in support of the operation. The grid box reference system is one method used to procedurally deconflict air reconnaissance missions. It is used as an informal airspace control measure and can be subdivided into 15nm by 15nm grid boxes, depending on the performance (range, altitude, and sensors) of participating air reconnaissance aircraft, and the potential threats in the area. When air reconnaissance platforms are employed they may be held at a control point (CP) outside their assigned ACA or be given an altitude restriction to stay above or below inside the assigned ACA until other friendly aircraft clear the airspace. Aircraft may check in with various controlling agencies as they proceed to their assigned reconnaissance area. The important thing to note is that if aircraft are talking

with the controlling agency and are able to transmit the appropriate IFF signal, they can transit direct from their air base, to their assigned ACA, and back again. See MCWP 3-16B, *The Joint Targeting Process and Procedures for Targeting Time-Critical Targets*, for more information on ACA's.

COMMUNICATIONS

Information exchange by tactical communication means is necessary to facilitate air reconnaissance in providing the MAGTF commander the situational awareness to shape the battlespace. Communications must be mission-tailored and redundant to ensure links between aircraft and MACCS agencies are maintained to minimize the chance of fratricide and enhance mission effectiveness. Flexibility and responsiveness of air reconnaissance communications is made possible by using a variety of techniques, including secure frequency agile equipment; appropriate countermeasures; disciplined emission control (EMCON); link systems; and standard communication nets.

The MACCS provides the functionality necessary for air reconnaissance coordination or control in the TACC. Regardless of MACCS agency, they will be the key element in passing information to and from the ACE Commander at the TACC, and to air reconnaissance aircraft. However, Marines find themselves more often than not operating in joint, combined, or multinational operations. The Navy uses the tactical air control center (TACC) and the Air Force uses the air operations center (AOC) to provide the same functionality the Marine TACC provides air reconnaissance in the MAGTF. In the joint or combined environment the JFC will designate a joint / combined air operations center (JAOC) to orchestrate theater operations and tasking. See Joint Pub 3-56. 1, *Command and Control of Joint Air Operations*, Navy Warfare Publication (NWP) 3-09. 11, *Supporting Arms in Amphibious Operations*, and MCWP 3-16B for a detailed discussion of functional equivalent agencies and command and control of joint air operations.

During the conduct of air reconnaissance operations beyond the FSCL, aircrew will check-in on a tactical air direction (TAD) net with the MACCS agency that provides deep air operations coordination. If possible, air reconnaissance missions should be conducted on a single TAD net, where threat warning and other information can be passed. Also, if the deep battle cell or an air reconnaissance platform has mission critical information to be passed, mission commanders can be contacted on this single TAD net. Air reconnaissance missions should check in with the MACCS control agency providing deep battle coordination. However, due to the high volume of communication between flight members conducting air reconnaissance, it may be necessary to assign separate TAD nets to each assigned mission.

When conducting air reconnaissance inside the FSCL, aircrew should check-in with the TAOC after which aircrew contact the DASC. The DASC should pass friendly situation and information about any other aircraft operating in the immediate vicinity. If the DASC is unavailable or can not be contacted, aircrews contact the local FSCC for friendly force locations. It is **critical** when conducting air reconnaissance inside of the FSCL that aircrew contact the appropriate organization to ensure the

effects from the ground force's fires will not interfere with the reconnaissance mission or disrupt friendly maneuvers.

Communications and Information Systems (CIS)

Air reconnaissance information is only of value if it gets to commanders and staffs in time to aid in planning and executing operations. The employment of digital imaging air reconnaissance systems within the MAGTF requires ground receiving and processing stations to disseminate and receive collected air reconnaissance information. Integral to any dissemination scheme is a reliable, secure, and effective intelligence CIS operation plan (see figure 2-4). Whether communications are analog or digital, voice or data, secure or nonsecure, there are hosts of technical details to ensure collected air reconnaissance information is disseminated in a timely fashion to the requestor. The sole purpose of the national imagery transmission format (NITF) is to ensure that commanders and customers receiving imagery and associated data are transmitted from/to secondary imagery dissemination systems (SIDS) in a standardized format. The following systems are used to exploit collected air reconnaissance information to provide commanders real-time or near-real-time information. For more information see MCWP 2-11, *MAGTF Intelligence Collection Plans*, and MCWP 2-15.4, *Imagery Intelligence*.
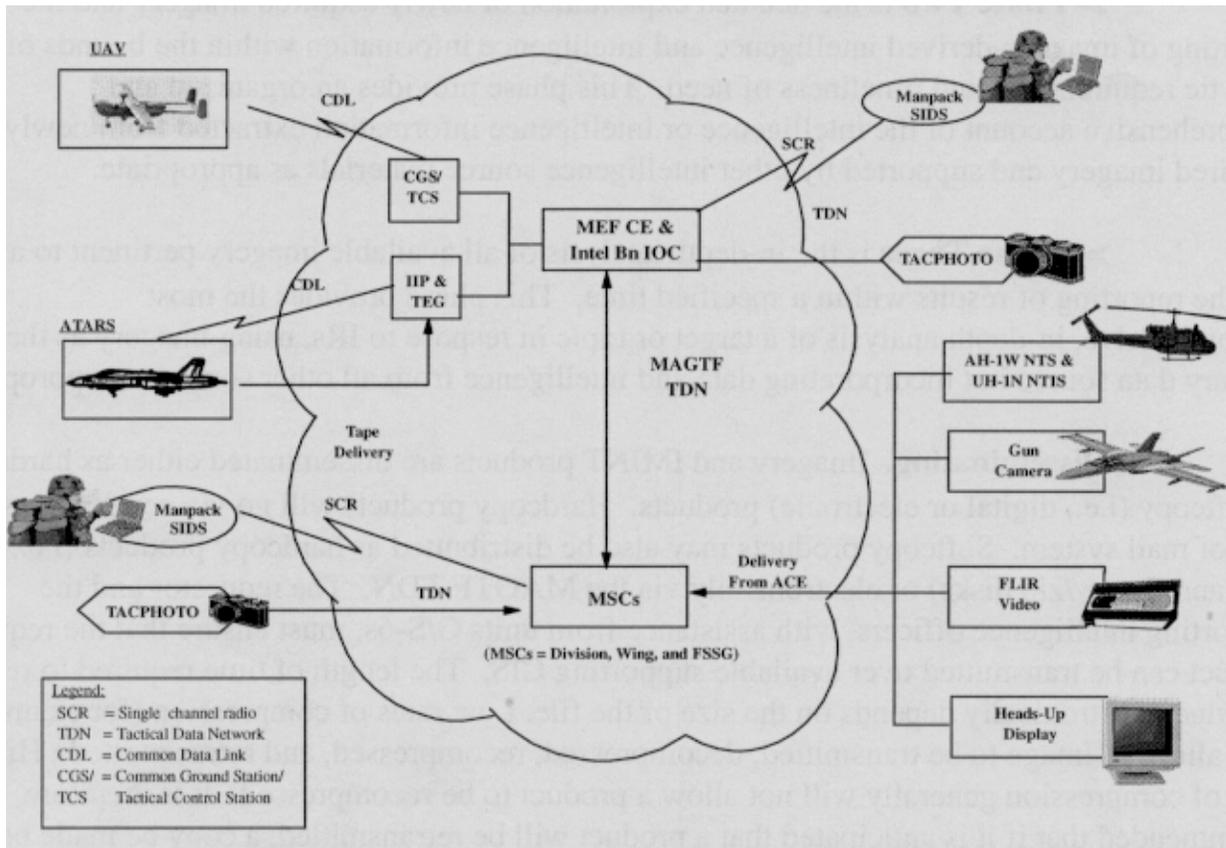
Communication Information Systems
Figure 2-4

Tactical Exploitation Group (TEG)

The TEG is a key MAGTF imagery intelligence (IMINT) system and is used as an imagery exploitation and analysis tool within the MEF. It is organic to each MEF's intelligence battalion's imagery intelligence platoon (IIP). It is capable of receiving, exploiting, and producing imagery and IMINT products and reports. The TEG provides the capability to receive, process, store, exploit, and disseminate imagery, to include ATARS electro-optical (EO), IR, and radar imagery; U-2 SAR imagery; and secondary imagery products from the Marine Corps imagery support unit (MCISU) and theater joint intelligence center (JIC). See MCWP 2-15.4, *Imagery Intelligence*, for more information on the mission, tasking, and organization of the intelligence battalion, IIP, and MCISU to provide imagery analysis support for MAGTF's and other commands as directed. Additionally, the TEG's equipment suite provides the capability to exploit film-based imagery and output from digital cameras, heads-up displays, FLIR, and camera tapes from various tactical aircraft. Once received, processed and exploited, the imagery is then transmitted over available secondary imagery dissemination system (SIDS) devices, MAGTF

tactical data networks (TDN), or other CIS resources. Upon fielding of the tactical interoperable ground data link (TIGDL) common data link (CDL), near-real-time exploitation and processing of ATARS imagery will be possible; until then, imagery data tapes must be downloaded and disseminated to the TEG post-mission. Even with the TIGDL CDL, only selected priority images will be downlinked, the remaining imagery data is stored on tape and downloaded following recovery.

The TEG is packaged in three high mobility multi-purpose wheeled vehicles (HMMWV) and three trailers (see figure 2-5). Due to its weight and balance, the TEG requires additional external lift capability in order to move the IIP and TEG within the area of operations. This additional lift, however, is not resident within the Intelligence Battalion and must be provided either by the MEF headquarters group or some other external source.

Full operational capability of the TEG is anticipated to occur during fiscal year 2001. The initial operational capability TEG allows for the processing of F/A-18 mission tapes and data link and is able to handle preprocessed national, U-2, UAV, and digital camera systems imagery. The full operational capability TEG will provide interoperability with all common imagery ground/surface systems baseline sensors (e.g., ATARS, Global Hawk) and will be able to handle all other preprocessed national imagery transmission format (NITF) imagery data. See MCWP 2-15.4, *Imagery Intelligence*, for more information on intelligence support, collection, and dissemination of imagery intelligence within and outside the MAGTF.
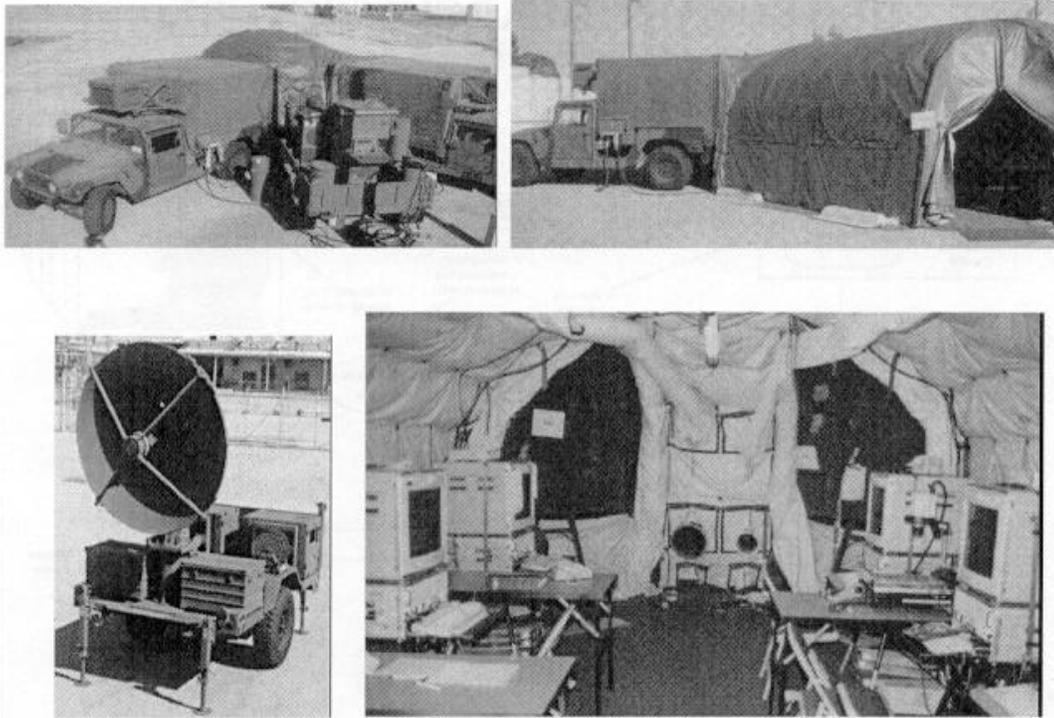
Tactical Exploitation Group Components

Vehicles and Power (upper left), Vehicle and Work Tent (upper right), Tactical Data Link (lower left), and TEG workstation (lower right)

Figure 2-5

Squadron Ground Station (SGS)

The primary method for exploiting ATARS imagery at the squadron level is from the SGS (see figure 2-6). This system is capable of interfacing with ATARS tapes only and has no data link capability. VMFA(AW) imagery analysts and aircrews review and exploit ATARS imagery via the SGS. The media produced from the SGS will be in a hard copy (picture), or soft copy format (CD-ROM). The soft copy format is capable of being transmitted through a SIDS (secret internet protocol router network (SIPRNET)). Softcopies of ATARS imagery can be delivered via data communications in a timely manner, providing there is sufficient connectivity, bandwidth, and peripherals to do so. The VMFA(AW) squadron may post imagery on its squadron, MAG, and/or MEF SIPRNET webpages. This allows viewing of the imagery by any interested command with access to the SIPRNET.
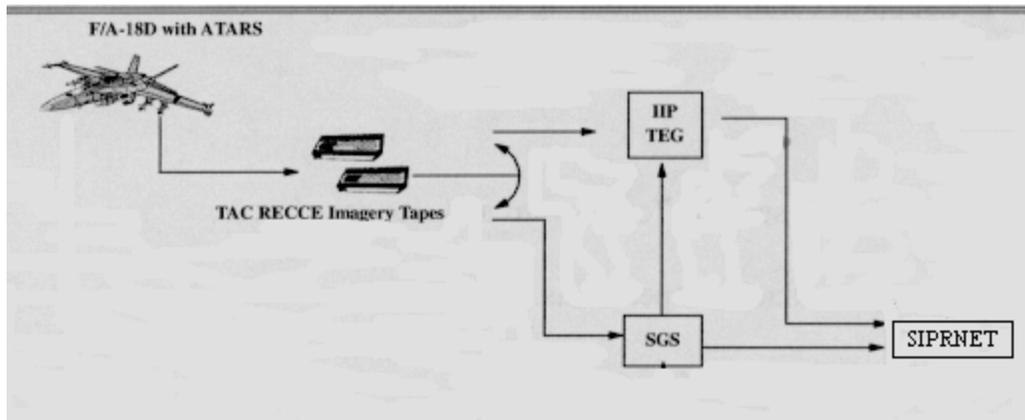
Exploitation of ATARS Imagery Via SGS/TEG
Figure 2-6

Tactical Aviation Mission Planning System (TAMPS)

The TAMPS has the ability to read in NITF format images. There are two problems however. The first is that imagery is not precisely located geographically as may be required, since it is only as accurate as the inertial navigation system (INS) in the aircraft. The second problem encountered is that the images are very large due to their large scale and high resolution. This causes the images to take up large amounts of space memory space on the computer, and are VERY slow to display on the screen.

Tactical Electronics Reconnaissance Processing and Evaluation System (TERPES)

The TERPES is an integrated, land-mobile, air-transportable data processing system organic to the Marine Tactical Electronic Warfare Squadron (VMAQ). The primary mission of the TERPES is to provide ground processing of electronic warfare (EW) information, including EW support and electronic attack, collected by EA-6B aircraft. TERPES supports VMAQ squadrons on deployments throughout the world, both land-based and carrier-based. The secondary mission is to provide electronic intelligence support to the MAGTF.

TERPES operates either in a rugged stand-alone shelter or as a portable unit. It operates within the MAGTF C4I architecture and maintains compatibility with both Navy intelligence systems aboard the carrier and Marine Corps intelligence systems such as the Intelligence Analysis System (IAS). TERPES also maintains the capability to interface with other DOD intelligence systems as required during joint operations.

TERPES directly supports information superiority for the MAGTF by maintaining a current electronic order of battle (EOB). TERPES collects, correlates, and fuses information received form EA-6B electronic support (ES) missions with data derived from theater and national sources. TERPES

provides the ACE with current EOB data that enables coordination and collaboration during detailed mission planning through the TAMPS and the tactical EA-6B mission support system (TEAMS).

The system provides mission planning and post-mission processing support to VMAQ electronic support measures (ESM) and electronic counter measures (ECM) operations, and intelligence support to other MAGTF elements. TERPES is an integral component of the Marine Corps intelligence system and a subset of the Marine tactical command and control system (TACC). TERPES processes and correlates digital ESM and ECM data collected and recorded on magnetic tape by EA-6B aircrews in mission planning by preparing an aircraft loadable digital tape. This data is a compilation of EA-6B aircraft weapons system initialization, operational flight programs, threat identification libraries, tactical, and other data as necessary for aircrew mission performance.

TERPES is a ground data readout system designed to process digital tapes containing electronic mission data. TERPES provides the MAGTF with rapid processing capability. TERPES has a stand-alone capability from outside intelligence agencies. TERPES and the tactical EA-6B mission planning system are required to support the EA-6B's electronic reconnaissance missions. The systems should be deployed along with the aircraft to reduce mission tape processing time. The VMAQ uses TERPES to process and report electronic information. See MCWP 5-4, *Signals Intelligence*, for more information on TERPES.

Ground Control Station (GCS)

The video picture produced by the UAV camera can be transmitted real-time to the supported unit or taped in the UAV's GCS or UAV for later dissemination and analysis. The black-and-white video resolution is sufficient to allow for imagery interpretation depending on the slant range distance when the video was acquired. See figure 2-7 for UAV system with control stations.

Mission Planning and Control Station (MPCS)

The UAV's MPCS consists of one mission planning station (MPS), two GCS's, and associated antenna ground data terminal (GDT) and communications equipment. Either station can plan and execute UAV missions. The MPCS, with the MPS and one GCS (each with its own GDT), serves as the operations center for the UAV squadron mission control team. (The terms MPS/GCS are basically interchangeable except the MPS has more data storage and computing capability). The MPCS is a small, modular control station installed in a shelter. The control shelter includes the UAV and map and terrain data, computer interfaces, nuclear, biological, and chemical (NBC) protection, and communications and information systems equipment. The shelter is mounted on a high mobility multipurpose wheeled vehicle (HMMWV), thus making the station easy to transport and quick to deploy. The main functions of the MPCS are to control and monitor the operation of the UAV(s) and the installed payload(s), and to provide initial product analytic capability to rapidly determine the relative

tactical value of the product (subsequent analysis can be accomplished at the appropriate level using the mission video tapes).

UAV System with Control Stations
Figure 2-7

Ground Data Terminal (GDT)

The Pioneer UAV system has two GDT's. The GDT controls all UAV tracking and communication functions, manages all up and down link data processing, and may perform preflight and system diagnostic tests. The GDT houses the radio transceiver and antenna subsystems for the ground control station and is slaved to it by remote cables. The GDT may be remoted up to 400 meters from the GCS via fiber optic cable.

Remote Video Terminal (RVT)

The UAV's RVT, also called the remote receive station (RRS), is a miniature television receiver with video recorder. It is used by commanders and their staffs to receive real-time video pictures to

supplement voice reports received from the MPCS. Directional antennas provided with each RVT allow for video reception up to approximately 40 kilometers from the selected UAV. The RVT is small enough to be carried in light vehicles or trailers.

The Pioneer UAV system has four RVT's. The RVT provides real-time video displays from a UAV. The location of the RRS's is at the discretion of the MAGTF or supported commander. Frequency allocation and control, especially UAV up link and down link control frequencies, must be carefully coordinated by the MAGTF G-6/S-6 to reduce adjacent channel interference and enhance flight safety. VMU squadron and the MAGTF electronic warfare officer will coordinate with MAGTF communications and electronic warfare elements to exclude the UAV up and down link control frequencies from any friendly radio interference. Communications security is a principle consideration in all communications planning due to UAV vulnerability to enemy electronic warfare jamming operations.

Radio nets are established to satisfy VMU squadron communication requirements during MAGTF operations. These nets are not intended to preclude the establishment of additional circuits to meet unique situational requirements. The GCS is required to maintain appropriate communications with the controlling headquarters and the MACCS airspace management agency throughout flight operations. See MCWP 2-15.4, *Imagery Intelligence*, for more information on coordination nets established for UAV operations.

Joint Service Imagery Processing System (JSIPS)

The Marine Corps imagery support unit (MCISU) provides exploitation and dissemination of national imagery received by the JSIPS, to garrison and deployed Marine forces. The Marine Corps has one deployable JSIPS, located at Camp Pendleton, California, and will normally remain in the U.S. working in a networking mode in communication with deployed units.

JOINT FORCE COMMAND AND CONTROL RELATIONSHIPS

All military operations in the future will be joint operations. The Marine Corps' most significant contribution to joint operations is the Marine air-ground task force (MAGTF). Marine aviation, whether influencing action within a MAGTF perspective or working in direct support of a joint service component, has significant air reconnaissance capability to bring to a joint arena.

The MAGTF commander generally retains operation control of ACE assets during joint operations. In this role, the ACE supports MAGTF operations within the constraints of joint operations. The MAGTF commander can also be tasked by the joint force commander (JFC) to provide sorties for tasking through the Joint force air component commander (JFACC). This tasking normally includes sorties for air defense, long-range interdiction, and long-range reconnaissance. Any sorties in excess of the MAGF direct support requirements are also made available to the JFC. The JFC uses the available sorties to support the JFC's operations, campaign objectives, or other components of the joint force.

Sorties provided for air defense, long-range interdiction, and long-range reconnaissance are **not considered excess sorties** and will be covered in the air tasking order (Joint Pub 0-2, *Unified Action Armed Forces (UNAAF)*).

The MAGTF commander can also request aviation support form the JFC when organic air reconnaissance assets are insufficient to meet MAGTF requirements. The guidelines for the relationship between the MAGTF commander and the JFC regarding aviation assets are contained in the *Policy for Command and Control of USMC TACAIR in Sustained Operations Ashore* (Joint Pub 0-2). The following publications contain more information about command relations for air support in joint force operations:

*   Joint Publication 3-0, *Doctrine for Joint Operations*
*   Joint Publication 3-56.1, *Command and Control of Joint Air Operations*
*   MCWP 3-2, *Aviation Operations*
*   MCWP 6-2, *MAGTF Command and Control*

SUMMARY

Command and control is unique for air reconnaissance operations in support of the MAGTF. While the MAGTF commander retains control of air reconnaissance assets, the MAW CG or ACE commander is responsible for manning, training, and equipping the squadron. This unique relationship requires detailed and thorough understanding of the operational and intelligence requirements for multi-mission platforms supporting the MAGTF. The TACC provides the ACE commander the ability to exercise centralized command and decentralized control of MAGTF air assets and operations.

Air reconnaissance missions require a flexible, efficient, and controlled system to ensure the assets committed to these missions are able to effectively collect information in a timely manner. The use of the DASC, deep battle cell within the TACC, and the MACCS can greatly increase the responsiveness of our limited air reconnaissance assets. Prior to executing air reconnaissance missions, the TACC must ensure coordination and communication with MACCS agencies is accomplished to avoid conflicting with other missions and friendly forces inside and outside the FSCL. It is important that timely, accurate information flow throughout the MACCS control agencies, and radio in and out procedures are understood by all participating units and aircrews. Furthermore, aircrews should send in-flight reports as time and the situation allows. Airspace coordination measures, whether formal and informal, or positive and procedural, will ensure the safe, efficient, and flexible control of air reconnaissance aircraft in the area of operations.

Air reconnaissance information is only of value if it gets to commanders and staffs in time to effect plans and execution. Integral to any dissemination scheme is a reliable, secure, and effective intelligence CIS operation plan. Whether communications are analog or digital, voice or data, secure or nonsecure,

there are hosts of technical systems to ensure collected air reconnaissance information is disseminated in a timely fashion to the requesting unit.

The JFC uses available MAGTF sorties to support the JFC's operations, campaign objectives, or other components of the joint force. Sorties provided to the JFC for long-range reconnaissance are **not considered excess sorties**.

Chapter 3

Planning

"Proper planning is essential to the execution of maneuver warfare. Planning is an inherent and fundamental part of command and control, and commanders are the single most important factor in effective planning. Maneuver warfare demands a flexible approach that adapts planning methods to each situation, taking into account the activity being planned."

MCDP 5, *Planning*

As the eyes and ears of the aviation combat element (ACE), air reconnaissance provides critical intelligence information that is required to support the planning process for MAGTF operations. The MAGTF commander uses air reconnaissance to gain information vital to shaping the battlespace. It assists the commander in understanding the situation, alerts him to new opportunities, and helps him assess the effects of actions upon the enemy that will lead to mission success through decisive actions. Air reconnaissance supports the intelligence warfighting function and is integrated into the overall operational effort.

To gain and maintain tempo, commanders, staffs, and aircrew must be involved in all modes and levels of air reconnaissance planning to ensure a constant flow of information vertically within the chain of command and laterally among staff sections. The rapid dissemination of imagery made possible through the digitization tightens the decision-making loop to the point where it is constrained more by the ability to decide, rather than the waiting for the information required to support those decisions. With the advent of GPS guided munitions, the necessity for efficient liaison between operations and intelligence is required to meet the demands of a GPS intensive conflict.

Planning activities occupy a hierarchical continuum that includes conceptual, functional, and detailed planning. At the highest level (MAGTF) is conceptual planning. At the lowest level (aircrew) we have detailed planning. Between the highest and lowest level (ACE) is the functional level that involves elements of both conceptual and detailed planning in different degrees. See MCDP 5, *Planning*, for more information on the planning hierarchy. This chapter focuses on elements critical to air reconnaissance planning at the Marine air-ground task force (MAGTF), aviation combat element (ACE), and aircrew levels.

Section I

MAGTF

The key to planning at the MAGTF level is through appropriate representation of warfighting functions; command and control, maneuver, fires, intelligence, logistics, and force protection. Through integrated planning of these fundamental functional areas we can eliminate many of the omissions that have proven fatal to plans in the past and better visualize the interactions throughout the battlespace that will occur in execution.

An operational planning team (OPT) may be formed to focus the planning effort and gather relevant planning expertise. Normally, the OPT is built around a core of planners from either the future plans section or the future operations sections. The OPT may also be augmented by warfighting function representatives, liaison officers (LNO's), and subject matter experts needed to support planning. See MCWP 5-1, *Marine Corps Planning Process*, for more information on OPT's. The OPT serves as the linchpin between future plans, future operations, and current operations sections. (See figure 3-1)
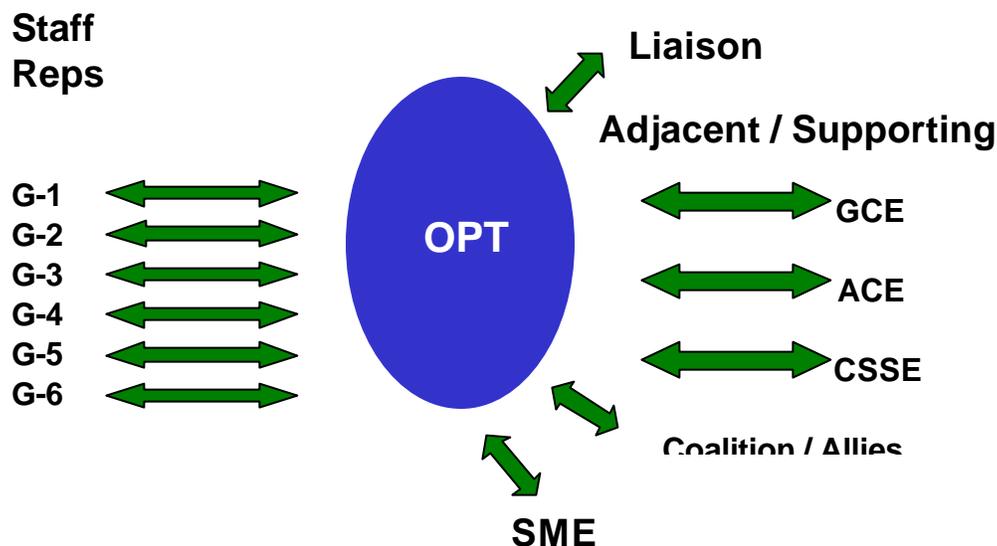
Appropriate Representation
Figure 3-1

Not only does the MAGTF use integrated planning within the staff, but also it uses the OPT as a vehicle to integrate planning among major subordinate commands (MSC's). (See figure 3-2) The MSC command elements and their respective OPTs pass information to their common higher headquarters, the MAGTF, while integrating and coordinating their own efforts among themselves. ACE representatives in the OPT provide MAGTF planners with inherent capabilities and limitations of the ACE in planning air reconnaissance operations.
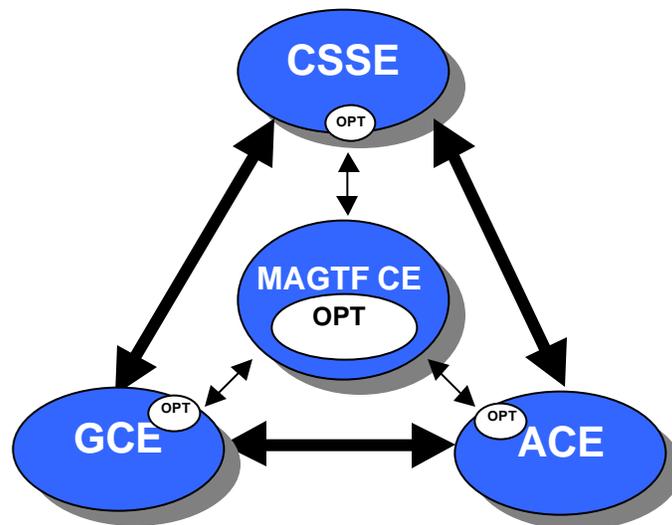
Staff Planning Relationships
Figure 3-2

The MAGTF begins the planning process through **mission analysis** (see figure 3-3). Its purpose is to review and analyze orders, guidance, and other information provided by higher headquarters and to produce a unit mission statement. Intelligence preparation of the battlespace (IPB) begins immediately and continues throughout the planning process. See MCWP 2-1, *Intelligence Operations*, for more information on intelligence support in planning and conducting MAGTF operations. Mission analysis produces an initial cut on high value targets (HVT's), and intelligence critical to mission success. IPB products support the staff in identifying or refining centers of gravity (COG) and determining critical vulnerabilities. See MCWP 3-16A, *Tactics, Techniques, and Procedures for the Targeting Process*, and MCWP 3-16B, *Targeting*, for more information on the targeting.

During mission analysis the commander's critical information requirements (CCIR's) identify information on friendly activities, enemy activities, and the environment that the commander deems critical to maintaining situational awareness, planning future activities, and assisting in timely and informed decision making. The CCIR's are central to effective information management, which directs the processing, flow, and use of requested information throughout the MAGTF.

Higher Commander's Directives

Execution

Mission Analysis

Transition

COA Development

Orders Development

COA War Game

COA Comparison & Decision
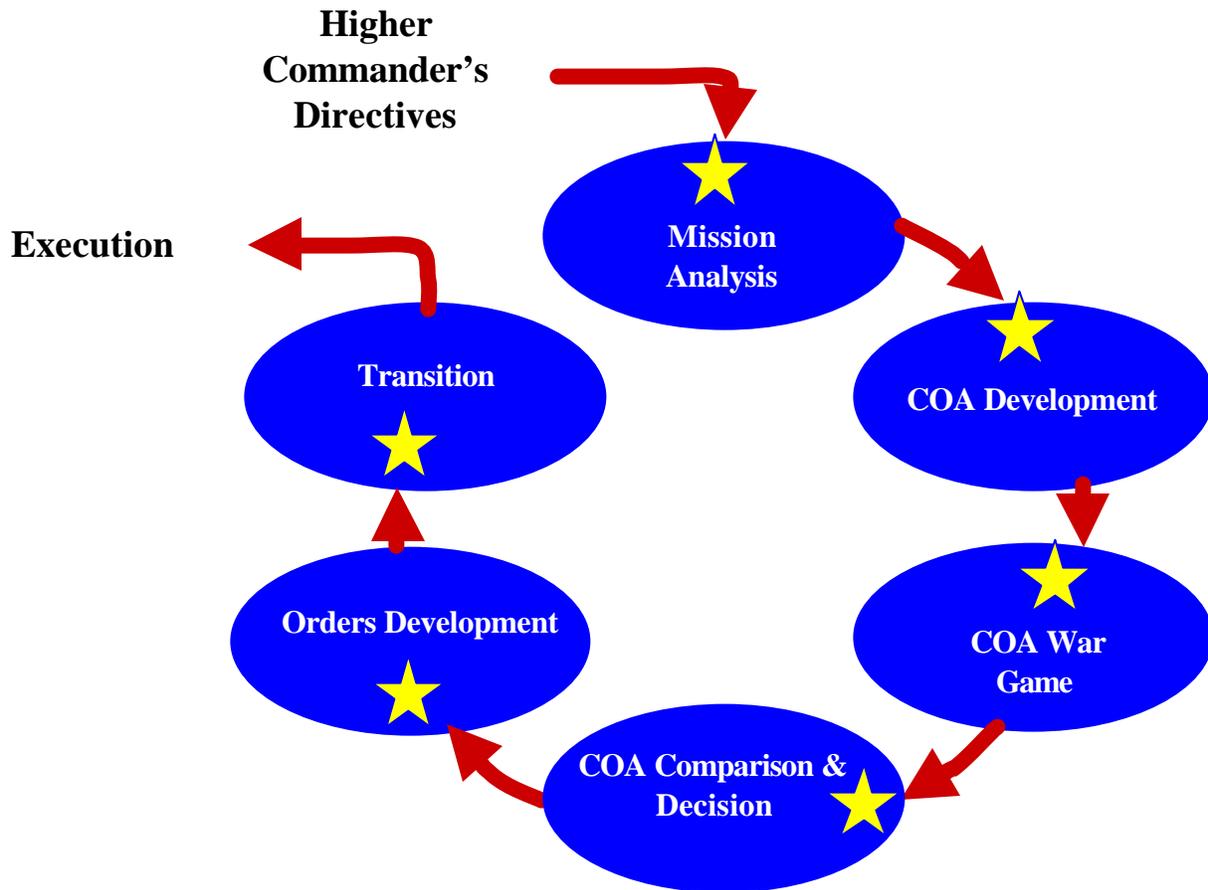
Marine Corps Planning Process
Figure 3-3

During **courses of action (COA) development**, planners use the MAGTF commander's mission statement (which includes the higher headquarters commander's tasking and intent), commander's intent, and commander's planning guidance to develop COA(s). This provides further clarity and focus on information requirements and the targeting effort to achieve the commander's purpose and the desired end-state. During COA development IPB enables planners to view the battlespace in terms of the threat and the environment, and the mutually supporting concepts of fire and maneuver identify HVT's in shaping the battlespace. The targeting effort refines those HVT's identified and begins to develop specific high payoff targets (HPT's). HPT's are those targets that give us the greatest effect for the least expenditure of time and resources to achieve to decisive action in achieving the MAGTF's mission. As planners develop COA's, IPB is updated and centers of gravity are refined. The MAGTF commander makes decisions on air reconnaissance apportionment with recommendations from the GCE, ACE, and CSSE commanders. This may include requesting additional air reconnaissance assets

through the joint force commander (JFC) to meet the MAGTF commander's request for additional information. See MCWP 3-16A, *Tactics, Techniques, and Procedures for the Targeting Process*, for more information on air reconnaissance in support of the targeting process and target development.

Courses of action wargaming assists planners in identifying friendly and possible enemy strengths and weaknesses, associated risks, and asset shortfalls for each COA. Wargaming validates what specific conditions need to be established that will lead in defeating the enemy's COG. It is during this stage that HPT's are finalized and the air reconnaissance plan is modified.

In **COA comparison and decision**, the commander evaluates all friendly COA's against established criteria, then evaluates them against each other. The commander then selects the COA that will best accomplish the mission. After the commander selects the COA, the staff prepares the concept of operations that is the basis of the next step, orders development. The concept of operations provides the foundation for the sequence of supporting concepts; such as, fires, logistics, and force protection. Based on the selected COA, the MAGTF commander will apportion aviation assets to achieve the effort required for air reconnaissance. The MAGTF commander may request additional air reconnaissance assets from the joint force commander (JFC) to meet MAGTF collection and operational requirements through recommendations from the MAGTF G-2/S-2, MAGTF force fires coordinator, and ACE commander. See MCWP 3-2, *Aviation Operations*, for more information on apportionment of MAGTF aviation assets.

During **orders development**, the staff uses the commander's COA decision, mission statement, and commander's intent and guidance to develop orders that direct unit actions. Orders serve as the principal means by which the commander expresses his decision, intent, and guidance. It directs actions and focuses the ACE's and other subordinate's tasks and activities toward accomplishing the mission.

Transition is an orderly handover of a plan or order as it is passed to those tasked with execution of the operation. It provides those who will execute the plan or order with the situational awareness and rationale for key decisions necessary to ensure there is a coherent shift from planning to execution. During execution the plan is continuously updated and modified as necessary to ensure the desired effects meet MAGTF objectives.

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Section II

ACE

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The tactical air command center (TACC) is the operational command post from which the ACE commander and his staff plan, supervise, coordinate, and execute MAGTF air reconnaissance operations. The ACE plans concurrently with the MAGTF and aircrew in support of air reconnaissance operations. The constant flow of information flows vertically within the chain of command and

horizontally within the ACE. An operational planning team (OPT) may also be formed at the ACE level in order to plan and facilitate coordination between MAGTF and subordinate commands.

The ACE supports the MAGTF commander's concept of operations and provides recommendations, capabilities, and limitations of ACE assets to perform air reconnaissance. The number of air reconnaissance requests, sorties available, and surge requirements affect the ability of the ACE to support MAGTF operations. Aviation assets organic to the ACE provide the MAGTF commander visual, imagery, and electronic reconnaissance to collect information in the battlespace.

Based on the ACE commander's mission and intent, the ACE staff will develop specified and implied tasks to achieve the level of effort required by air reconnaissance in supporting the MAGTF's intelligence collection requirements and concept of operations. This section focuses on air reconnaissance planning at the ACE level.

During **mission analysis** the ACE staff analyzes the MAGTF commander's objectives and guidance.

- Objectives are the MAGTF commander's goals to achieve. They provide a means to determine priorities and set the criteria for measuring mission success.

- Guidance sets the limits or boundaries on objectives and how to attain them. It provides the framework to achieve the objectives and establishes force employment scope and restrictions. Rules of engagement (ROE) are an example of guidance.

The ACE reviews and analyzes orders, guidance, and other information provided by the MAGTF. The ACE commander's intent guides the ACE staff throughout air reconnaissance planning and execution. The ACE staff assists the MAGTF in identifying COG's. For example, an enemy's anti-aircraft artillery (AAA) may be a COG for the ACE in conducting air reconnaissance operations. The effects of terrain, weather, and other surface-to-air threats can also significantly degrade the ability of air reconnaissance assets in conducting air reconnaissance operations.

Air reconnaissance supports the intelligence function from the beginning of planning phase through the execution of MAGTF operations. It provides a major means of collecting current information about the terrain, weather, hydrography, and enemy situation. Air reconnaissance does not conduct targeting but provides target acquisition and collects information used in the intelligence cycle and targeting process. The G-2/S-2 officer plans and coordinates air reconnaissance requests for the MAGTF. The Marine Corps intelligence system processes and disseminates the raw information or data from Marine reconnaissance aircraft to commanders and their staffs as analyzed intelligence products.   Air reconnaissance missions are flown in response to specific requests to:

- Conduct air reconnaissance, surveillance, and target acquisition (to include imagery collecting and reporting) of designated target areas and areas of interest.
- Provide air reconnaissance for combat search and rescue, and tactical recovery of aircraft and personnel.
- Provide air reconnaissance of helicopter landing zones, and approach and retirement lanes in support of vertical assaults.
- Provide air reconnaissance information reporting to support MAGTF intelligence requirements and facilitate all-source intelligence operations.
- Provide air reconnaissance information to assist adjusting direct (artillery and naval gunfire) and indirect-fire weapons and to support and facilitate deep air support (DAS).
- Collect air reconnaissance information to support battle damage assessment and combat assessment.
- Provide air reconnaissance to support rear area security.
- Provide and maintain airborne surveillance of enemy activities or areas of interest.
- Provide airborne electronic reconnaissance in identifying the enemy's electronic order of battle and threat emitter locations.
- Provide the MAGTF the ability to sustain surveillance in areas of operations.
- Provide rapid and current air reconnaissance information on enemy composition, disposition, activity, and installations.
- Provide observation of ship to shore movements.
- Provide imagery to update to existing maps and support terrain analysis.
- Provide treaty verification.

See chapter 4 for more information on specific air reconnaissance tasking for visual, imagery, and electronic reconnaissance in MAGTF operations and military operations other than war (MOOTW).

During **courses of action (COA) development**, planners use the ACE commander's mission statement (which includes the MAGTF commander's essential, specified, and implied tasks, and intent), commander's intent, and commander's planning guidance to develop COA(s). This provides further clarity and focus of the planning effort to determine what conditions need to be set that will achieve the MAGTF commander's objectives. ACE planners determine what air reconnaissance aircraft/sensors will be required to achieve the desired intelligence information required by the requesting unit. They also figure out what resources (sorties, sensors, logistics, time, etc.) are required for sustained or surge operations.

The following considerations affect the ACE staff in developing the level of effort required by the ACE to support each COA:

- The types of aircraft and sensors available to achieve the required air reconnaissance requests.
- Support requirements (SEAD, fighter escort, aerial refueling, etc.).

- The level of effort required to provide air reconnaissance directly relates to the MAGTF commander's specific objectives.
- Factors that may restrict the types of air reconnaissance aircraft (manner or unmanned) and/or types of sensors; such as, time of day, distance to the target, time on station, weather, visibility, terrain, and target area defenses. See chapter 4 for a detailed discussion of low, medium, and high level threats associated with air reconnaissance operations.
- Target acquisition probabilities for selected the air reconnaissance platform and its sensors.
- The desired time for conducting air reconnaissance is focused in support of the MAGTF's concept of operations.
- Restrictions imposed by National leaders and ROE, or to prevent an undesirable degree of escalation due to theater conditions.
- Ability of the MACCS to monitor the battlespace to provide air reconnaissance operations proper cueing and threat warning, specifically ingress routes, areas assigned for air reconnaissance operations, and egress routes. If the MACCS is unable to provide the surveillance required to support air reconnaissance operations, the ACE needs to coordinate through the MAGTF commander to request joint or combined early warning assets to provide the surveillance coverage required.

When planning for the use of unmanned aerial vehicles (UAV's), and fixed-wing and rotary-wing aircraft for continuous combat operations, it is important that planners know the daily sustained and surge sortie rates for each type of aircraft. Aircraft require maintenance cycles and a minimum amount of time to load, arm, fuel, and service. A planner will determine the turnaround time (time to load, arm, fuel, and service) and the total number of sorties each type aircraft can fly per day. See MCWP 5-11.1, *Aviation Planning*, for more information.

The weapon system planning document is available for each aircraft and provides the planned sustained and surge combat rates for a particular aircraft. It is used for planning logistics and maintenance requirements for specific aircraft. It may be used as a guide, but planners should be familiar with actual aircraft capabilities and sustained requirements. The weapon system planning document is classified and can be obtained from Headquarters USMC (APP or NAVAIR), via the chain of command.

Courses of action wargaming assists ACE planners in identifying friendly and possible enemy strengths and weaknesses, associated risks, and asset shortfalls for each COA. When wargaming air reconnaissance operations, determine the effects of weather, refine estimates, and when to surge to achieve the MAGTF commander's information and support requirements through air reconnaissance. Wargaming may reveal additional logistical and aviation support requirements to support MAGTF air reconnaissance operations for selected COAs. It is during this stage in the planning process that air reconnaissance force requirements are finalized and the plan is modified for each COA.

In **COA comparison and decision**, the ACE planning staff evaluates all COAs against established criteria. The COAs are then evaluated against each other. The ACE commander selects the COA that is deemed most likely to achieve air reconnaissance objectives in support of the MAGTF commander's concept of operations based on the following considerations:

- Does the level of effort required meet the MAGTF commander's objectives?
- Will surge or sustained air reconnaissance operations limit the ACE's ability to support other current or future MAGTF and/or joint operations based on aircraft availability, sensor availability, and logistical support requirements?
- Is the level of risk acceptable?

The MAGTF commander uses the recommendations of the ACE commander and staff and the MAGTF G-2/S-2 officer to make apportionment decisions. They may recommend to the MAGTF commander that joint and/or national air reconnaissance systems are required to support MAGTF operations. From the selected course of action, the MAGTF's apportionment (percentage) of the aviation effort toward air reconnaissance is translated by the ACE into allocation (number) of sorties for air reconnaissance missions. See MCWP 3-2, *Aviation Operations*, for more information on the apportionment and allocation of aviation assets.

During **orders development**, the ACE staff takes the commander's COA decision, intent, and guidance and develops orders to direct the actions of the unit. The operation order (OPORD) articulates the ACE commander's intent and guidance for air reconnaissance missions.

The air tasking order (ATO) is a means for disseminating tasking on a daily basis. It provides subordinate units, and command and control agencies projected sorties/capabilities/forces to targets and specific missions. Concurrent with the ATO development, the ACE staff coordinates with prospective squadrons that will be assigned air reconnaissance missions. This facilitates continuous information sharing, maintains flexibility, and makes efficient use of time. See MCWP 3-2, *Aviation Operations*, and MCWP 3-25.4, *Marine Tactical Air Command Center Handbook*, for more information on the ATO process.

Transition is the orderly hand over of the plan or order as it is passed to those tasked with execution of the operation. It provides mission executors with the situational awareness and rationale for key decisions that are necessary to ensure a coherent shift from planning to execution. For aircrew, transition occurs when the ATO is transmitted, during which aircrew who are going to be conducting air reconnaissance missions are given the specific mission requirements for detailed planning.

Section III

Aircrew

Upon receipt of the mission, aircrews begin detailed mission planning. Aircrews select tactics and techniques that offer the best chance of mission success. The commander's intent is relayed as the purpose of the mission, which allows planners to adapt to changing situations and to exercise initiative throughout the process. Basic air reconnaissance planning begins with analysis of mission, enemy, terrain and weather, troops and support available, and time available (METT-T). Additional factors will determine the tactics and techniques required to conduct particular air reconnaissance missions.

- **Mission**. Planners study the ATO to understand their objective, the specified and implied tasks to be performed in accomplishing the objective, and the commander's intent or purpose for conducting the mission. This understanding increases overall situational awareness by all participants and facilitates the initiative required to maximize air reconnaissance effectiveness. As stated in chapter one, missions listed on the ATO are preplanned (scheduled or on-call).

- **Enemy**. By determining key enemy characteristics, such as composition, disposition, order of battle, capabilities, and likely courses of action (COAs), planners begin to formulate how air reconnaissance can best be employed. From this information, air reconnaissance planners anticipate the enemy's ability to affect the mission and the potential influence enemy actions may have on the mission's tactics and techniques.

- **Terrain and Weather**. A terrain study is used to determine the best routes, navigational update points, and terrain masking to limit detection by enemy radar. Terrain may also restrict the type of air reconnaissance sensor that can be used. Weather plays a significant role in air reconnaissance operations. It influences the capability to acquire, identify and accurately locate air reconnaissance targets and information. Weather will affect air reconnaissance tactics and sensors to be utilized. Planners at every level require an understanding of the effects that weather can have on air reconnaissance aircraft's navigation, sensors, and weapon systems. The weather can also change the mission from low threat to high threat depending on the enemy's capabilities and the aircrew's ability to see and defend against enemy surface-to-air missiles (SAMs). When forced to fly under a cloud layer it is easier for enemy ground forces to acquire and engage air reconnaissance aircraft. With the addition of ATARS in the Marine Corps air reconnaissance inventory, acquisition of targets in adverse weather is a capability with the F/A-18's synthetic aperture radar (SAR).

- **Troops and Support Available**. Ideally the support required to conduct air reconnaissance missions is identified early in the planning process. Support for air reconnaissance missions can be requested with sufficient time to coordinate its use. Mission support requirements that must be

determined include escort, electronic warfare (EW), SEAD, aerial refueling, forward arming and refueling points (FARP's), and C3 systems that includes imagery exploitation systems.

- **Time Available**. Air reconnaissance planners must estimate the amount of time necessary to plan the mission, effect the necessary coordination, execute the mission, and exploit collected air reconnaissance information. Inadequate time management may result in reduced effectiveness and increased risk to aircrews, UAV's, and possibly ground forces.

ACQUISITION CONSIDERATIONS

Collecting information about the terrain, weather, hydrography, and enemy situation will weigh heavily into the air reconnaissance planning equation. If the objective is easy to find, like a bridge, it will determine what type of aircraft, sensor, and tactics are to be employed in acquiring the information requested through air reconnaissance. If the target is hard to find, the same holds true. Heavily defended areas of interest may require the use of standoff acquisition sensors. Their high probability of success in acquiring information and the ability to acquire it from a greater distance will enable aircrews and UAV's a high chances for success, and increase their survivability. The type and characteristics of air reconnaissance information requested will very greatly. Aircrew should consider the following when selecting air reconnaissance tactics and sensors for acquisition:

Visibility

Visibility is more critical for long-range acquisition than it is for short-range. Thick haze or smoke can have a greater effect on low-level air reconnaissance than on high-level due to the horizontal visibility usually being lower than the oblique/vertical visibility. If air reconnaissance aircraft cannot see their objectives due to adverse weather, then they may not be able to obtain the information required to support the MAGTF in planning and executing operations. The availability to acquire air reconnaissance information may depend on the rules of engagement (ROE). Theater ROE may impose altitude restrictions on air reconnaissance aircraft and UAV's due to adverse weather and visibility. These restrictions may prohibit air reconnaissance sensors and aircrew from collecting information during the air reconnaissance mission. This may force another air reconnaissance mission, which will require more planning and sorties that could be used elsewhere. The time of day is another important visibility consideration due to the sun's angle and shadowing effects associated with sunrise and sunset.

Thermal Significance

Many variables can affect an air reconnaissance sensor's ability to detect thermal significant objects. Weather conditions, time of day (thermal crossover), and composition and background of the objective to be acquired should all be considered.

Radar significant target

The probability to successfully acquire and identify targets is improved with radar significant features. These radar significant features could be the target itself, terrain and cultural features surrounding the target, or other natural objects nearby the target. These radar significant features can improve aircrew situational awareness (SA) in the target area enabling better success for target acquisition and identification.

Orientation

Areas of interest and targets in close proximity to high terrain and other cultural features (such as an urban environment) may restrict the sensor's employment direction for successful acquisition. Orientation and range to other areas of interest or targets assigned in the same air reconnaissance mission may also effect the tactics and direction.

Enemy defenses

Enemy targets are usually defended by SAM's and antiaircraft artillery (AAA). Reducing exposure time, jinking, using standoff capable sensors, and suppressing these threats with electronic warfare (EW) minimizes losses from enemy air defenses during air reconnaissance missions. A low threat for one type of air reconnaissance aircraft may be a high threat for another. The selection of proper aircraft, sensors, and tactics is critical to the success of air reconnaissance operations.

Contrast and brightness

A major factor in acquiring air reconnaissance information is the contrast of the target against its background. Camouflaged targets against a background of similar color may be impossible to detect.

Target coordinates

Precise target location is important in the successful conduct of air reconnaissance in completing combat assessment. Accurate grid, latitude, longitude, target elevation, and prior target imagery are helpful for determining precise target locations for combat assessment. When utilizing sensors guided by global

positioning systems (GPS), precise coordinates increase the chances in collecting combat assessment information required to support the intelligence and targeting cycles.

Sensors

The joint task force (JTF), MAGTF, or ACE assigns air reconnaissance aircraft to specific air reconnaissance missions. When these air reconnaissance missions are listed in the ATO, aircrews need to ensure that the best sensor is utilized for mission success. Changes in the sensor load may be required due to a change in the weather, visibility, threat, or aircraft and sensor availability. If a change in the sensor is required, the sensor load change needs to be approved up the chain of command prior to executing the air reconnaissance mission.

Night

Night Vision Devices (NVDs) are susceptible to the same shadowing effects as during sunrise and sunset. The moon angle can effect aircrews' ability to collect information and acquire targets due to its low angle above the horizon in masking terrain. Illumination and weather also effect NVDs by reducing acquisition range or obscuring targets completely.

NAVIGATION

As discussed in chapter 2, airspace control measures in the ACP and ACO will simplify and reduce the time required by aircrews to plan navigation routing and to coordinate with friendly air defense and control units for air reconnaissance missions. When planning air reconnaissance missions, aircrews will normally follow MRRs or special corridors to and from the battlespace. When conducting air reconnaissance missions over areas of interest, aircrews will usually follow MRRs to the point where their ingress route begins, or they may be held at a control point until the search area is clear of other assets. Aircrews may check in with various controlling agencies as they proceed to their assigned search area. The important thing to note is that if aircrews are talking with the controlling agency and are able to transmit the appropriate IFF signal, they can transit direct from air bases to assigned search areas and back again. Depending on the threat's air surveillance capabilities, limiting friendly aircraft to specific MRR's or special corridors may make them more recognizable and vulnerable to enemy surface-to-air systems. If unable to talk or transmit the appropriate IFF signal (lame duck) due to battle damage or system failure, the most non-threatening profile of which the aircraft is capable should be flown. Aircrew's intentions should always be broadcast despite the inability to gain and maintain radio contact with friendly force air control agencies.

Other factors aircrews must consider during air reconnaissance mission navigation planning:

Threat

If unable to by pass the threat either above or around, planners need to minimize the time aircraft are exposed to the enemy surface-to-air threats and plan for SEAD support requirements along the route.

Range to target

Range to the target and tactical-speeds flown by aircraft may require aircraft to refuel pre-mission and/or post-mission. Air reconnaissance missions may require aircraft to fly a high altitude only profile, or carry less ordnance and more fuel tanks due to the long range. The range may also prohibit specific aircraft from executing the mission.

Altitude

Threat avoidance, denial of enemy early warning radar detection, range to the target or area of interest, weather, communication reception, and fuel required are all considerations for altitudes to be planned for on the route.

Navigational update point

Due to the inherent drift (accumulating error) in certain aircraft navigation systems, planners need ensure that easily identifiable update points (visual or sensor significant) are incorporated along the route. This will increase the accuracy in mission execution and the ability to collect air reconnaissance information on the target or area of interest.

LOGISTICAL SUPPORT

Air reconnaissance planners must allow sufficient time for the coordination and preparation of sensors and aircraft configuration. Determine sensor availability early in the planning process, so that time is not wasted planning on unavailable sensors. Anticipate utilization rates and plan for re-supply accordingly.

Air reconnaissance missions may not have specified targets or areas of interest known by aircrew prior to takeoff. These missions must follow the commander's guidance in prioritizing targets and information requirements, and base their air reconnaissance search on the enemy situation. Aircraft sensor, ordnance load, and configuration should be based on the MAGTF commander's guidance, intelligence estimates, and associated target precedence. Time-on-station, refueling either airborne or at a FARP, SEAD, and anti-air protection of air reconnaissance assets may also be required and should allow sufficient time to be planned and coordinated.

CONTROL AND COORDINATION MEASURES

When planning air reconnaissance operations, aircrews should take into consideration the ability of the MACCS to monitor the air reconnaissance area and surrounding areas. It may be quite difficult to effectively employ air reconnaissance sensors without the MACCS being able to sanitize the airspace. This would require air reconnaissance aircrew to concentrate more on looking for or possibly engaging enemy fighter aircraft in their assigned area.   Therefore, aircrew should have the best possible surveillance and communication system to provide proper cueing and threat warning to increase the probability of mission success.

The ability to communicate between aircraft and the MACCS is important during air reconnaissance operations. This can reduce friction during the execution phase. Communications can be voice, visual, or digital. The key to successful execution is the development of a simple, secure, and redundant communication plan. The fluid environment throughout the battlespace requires reliable communications between aircrews and commanders to ensure that important information is received through inflight MISREPS. Opportunities that present themselves can be exploited if communications are reliable. See appendix E for a sample of an air reconnaissance inflight report.

In MOOTW where friend and foe are usually in close proximity, effective communication will lesson the likelihood of fratricide.   Threat updates and changes to mission assignments are critical pieces of information that must be received by aircrews as quickly as possible. Often over-looked as a simple reliable communication technique is the use of color coding or marking of surface forces that are visible to aircrew.

Air reconnaissance spots and adjusts artillery and naval gunfire. These air reconnaissance missions can be conducted on both sides of the FSCL. The range of potential artillery and naval gunfire support missions from the FSCL will often determine how much coordination will be required with other forces. Normally, little or no integration with surface forces will be required when air reconnaissance is conducted beyond the FSCL. Special operations forces (SOF), and other surface units operating outside of the FSCL or very close to the FSCL must be deconflicted by air reconnaissance planners and monitored by the MAGTF or equivalent fire support coordination center. The deep battle cell should direct the appropriate deconfliction prior to and during the planning and execution of air reconnaissance missions.   Further, it is important for aircrew to plan for deconfliction of air reconnaissance aircraft transiting over friendly surface forces with other fire support going on inside of the FSCL.

AIR RECONNAISSANCE FORCE COMPOSITION

Air reconnaissance missions may require support from escort or electronic warfare aircraft. When conducting air reconnaissance, there are two basic employment options. The two options are force

concentration and defense in depth. Force concentration employs all airborne assets in a relatively tight formation, while defense in depth requires aircraft to be dispersed to allow for threat reaction. The size of the force may depend on multiple sensors and aircraft required to collect the necessary information and defend against enemy threats.

The key to planning a successful package composition is detailed intelligence on the enemy and effective early warning of the presence of threat aircraft. If enemy forces can be effectively identified and engaged prior to disrupting the air reconnaissance aircraft, both options have merit.

Force concentration

Force Concentration is used when the air-to-air threat is low. After determining the desired results of the air reconnaissance mission, the number of fighter and SEAD aircraft are determined. The goal of force concentration is to get the air reconnaissance aircraft through the target area in as short a time as possible. This reduces amount of time the air reconnaissance force is exposed to the threat. The mission commander can have increased situational awareness due to the proximity of air reconnaissance assets. Although force concentration tactics are good to use in low threat situations, it has application in high threat scenarios as well. Force concentration is also a very effective tactic to utilize at night to minimize confusion caused by dispersed formations.

Defense in depth

Defense in depth allows for greater dispersion of forces and may be utilized when the enemy has a credible air-to-air capability. For example, a fighter sweep may precede the main air reconnaissance package to ensure the reconnaissance area is free of enemy aircraft. Defense in depth will require detailed planning and coordination to ensure the proper spacing is maintained between air reconnaissance and escort aircraft. Escort aircraft may have difficulty in distinguishing friendly from enemy aircraft if the enemy gets by the escorts.

SUPPRESSION OF ENEMY AIR DEFENSE (SEAD)

SEAD is fundamental for effective employment of air reconnaissance. Planners should determine what surface-to-air threats are en route and in the reconnaissance area to provide the most economical and capable assets to suppress those systems. There are variety of ways to suppress enemy air defense assets depending on the range from the FSCL and number of threats in the target area. Typically, the FSCL will be established based on the range of the MAGTF commander's indirect fire weapons. If targets are inside the FSCL, the air reconnaissance planner may be able to coordinate with the MAGTF's indirect fire weapons to suppress enemy surface-to-air systems. Using artillery and mortars to provide SEAD support for air reconnaissance missions is economical for air reconnaissance, however, this may not be economical for surface forces. Using indirect fire weapons will also require a

spotter and increased coordination by air reconnaissance aircrew to be effective and also to prevent fratricide. Indirect fire weapons should be considered as an effective SEAD asset as long as the coordination and deconfliction are thoroughly conducted.

Coordination with the senior FSCC will be required when utilizing organic or non-organic indirect fires to suppress enemy air defenses short of the FSCL. It is important that coordination occur with the senior FSCC to ensure that indirect fires are cleared and deconflicted with other supporting arms. For example, when employing attack helicopters in a rotary-wing high threat environment, indirect fires may be the only continuous suppression assets available.

When conducting air reconnaissance operations outside the range of indirect fire assets, the air reconnaissance planner should plan on utilizing airborne SEAD assets. Airborne SEAD includes the employment of high-speed anti-radiation missile (HARM), tactical air-launched decoy (TALD), and electronic attack (EA). It is critical that air reconnaissance planners integrate SEAD to insure the greatest protection of our air reconnaissance assets. See Joint publication 3-01.4, *Joint Suppressions of Enemy Air Defenses (J-SEAD)*, and MCWP 3-22.2, *SEAD*, for more information. The key to SEAD planning is to provide a temporary sanctuary/window for air reconnaissance assets to accomplish their mission without prohibitive interference from the enemy.

SEARCH PATTERN

Air reconnaissance missions may require aircrews to search for targets due to no or little target information. There are three basic searches that can be conducted:

Area

Searches are limited to a specific area or named area of interest (NAI). Area air reconnaissance may need to be deconflicted with other assets and forces in the AO. Procedural controls and ACAs may be established to control aircraft operations (as discussed in chapter two). Area searches are normally used to find targets that may be dug in or to acquire targets not precisely located prior to aircraft launch.

Route

Route air reconnaissance is used to search a specific line of communications (LOC) and acquire enemy activity along critical avenues of approach or target areas of interest (TAI's). TAI's may be specific areas that the MAGTF commander may want monitored. Further, the MAGTF commander may base operational and tactical decisions upon enemy activity in TAIs, therefore, the ACE commander should insure air reconnaissance aircrew are aware of all active TAIs which may need to be searched.

Specific

Specific air reconnaissance is utilized to find particular targets or search specific NAI's or TAI's. Specific air reconnaissance missions may be utilized to find and acquire high value time-sensitive-targets. Combat assessment is also another type of specific air reconnaissance mission.

Formations used by air reconnaissance assets are based on two simple principles, target detection capability and the threat in the area. Due to the mobility of some surface-to-air systems and targets, it is very difficult to provide complete protection from enemy air defenses.   When planning air reconnaissance, planners should, at a minimum, consider including an EA-6B and an escort aircraft to be available as a reactive SEAD package.   The EA-6B is employed to conduct electronic reconnaissance and electronic warfare support over the area, and can suppress threats that may pop up. Aircraft capable of employing air-to-air missiles and HARM should escort the EA-6B. This offers protection to the EA-6B while adding weapon redundancy to the reactive SEAD package.

The altitude at which fixed-wing reconnaissance aircraft conduct air reconnaissance will vary based on the target size and threat. At night, if the threat is not exercising light discipline targets can be detected many miles away with night vision devices (NVD's). When fixed wing assets fly in section, the primary visual reconnaissance search area should be between the aircraft. This allows for overlapping search sectors and also facilitates mutual support between the aircraft. If four aircraft are employed, a box formation should be used with the trail element elevated. Rotary wing air reconnaissance assets will use terrain flight altitudes and operate in a manner to provide for mutual support. Each aircraft will be assigned specific search responsibilities based on aircraft systems.

A critical factor to the effective employment of air reconnaissance is communicating and distributing information via mission reports (MISREPs) or in-flight reports (IFREPs). By passing time sensitive information, aircraft can be diverted or additional aircraft assigned to exploit a critical enemy vulnerability.

NIGHT AND LIMITED VISIBILITY CONSIDERATIONS

Night and limited visibility air reconnaissance is demanding on aircrews and UAV operators, requiring a high degree of training to accomplish the mission successfully. Although, night and limited visibility air reconnaissance is more demanding, it can be used as an advantage to acquire enemy forces during times when they least expect. Presently, no force in the world can compare with the night time capabilities of United States (US) forces. Specifically, the MAGTF commander has a decided advantage to impose his will on the enemy regardless of weather and environmental conditions. This advantage can only be realized with the continued development of aircraft systems and sensors, and aircrew training.

Successful night and limited visibility employment depends heavily on the aircraft's sensors and the aircrew's ability to utilize them. Today's developing sensors can readily acquire targets with a known

target location and may not be effected by weather or time of day if planned properly. However, the majority of the air reconnaissance targets' locations are unknown and require aircrews skill to acquire and identify air reconnaissance information that can be easily interpreted airborne or analyzed by intelligence personnel to support MAGTF intelligence requirements and operations.

Basically, there are four ways to identify and acquire targets during night and limited visibility: visually, sensor, infrared (IR), and night vision devices (NVD's). The specific tactical considerations for night and limited visibility operations are essentially the same as day operations. However, some unique points must be considered. For example, the use of aircraft navigation and formation lights to control tactical formations.

SENSOR CONSIDERATIONS

Some of the biggest advancements in technology have been the development of aircraft sensors to recognize and acquire targets. This technology is advancing quickly and will be the foundation for new tactics and doctrinal development in the future. Today the technology available is extremely capable, as long as aircrews are trained in its employment. Listed below are some the systems that may be used to recognize and acquire targets via aircraft sensors:

- Thermal or infrared sensors distinguish objects via differentiating the object's temperatures to the background of where the object is located (typically the earth). An example of this type of sensor is the forward looking infrared (FLIR) employed by most US attack aircraft (see appendix B for aircraft capable of employing FLIR). Thermal sensors are very ineffective when target to background temperatures vary by only a few degrees. These sensors are limited during periods of thermal cross over which typically occurs near sunrise and sunset.

- Aircraft radar can be used in a variety of ways to recognize and acquire targets. They can locate radar reflective targets regardless of whether the target is moving or stationary. Most radars employed onboard US aircraft have the capability to track moving vehicles. Further, stationary materials that reflect radar energy to varying degrees, specifically buildings, roads, bridges, and runways are more easily recognized and attacked using aircraft radar. Terrain and other natural features (e.g., rivers, hills, and mountains) can also be radar significant to help acquire target areas and specific targets.

- Night vision devices (NVD) have dramatically improved the capability for US forces to "own the night." With proper training and education, the use of NVDs may provide aircrew with another sensor that can be employed throughout the flight envelope to enhance safety and tactical execution.

Night and limited visibility execution may be enhanced by using the electro optical target decision aid (EOTDA) computer program which may be used to predict the capability of on board aircraft sensors to detect targets. The EOTDA program uses the forecast weather prediction for the air reconnaissance area, the target's electromagnetic signature, the areas cultural/natural background, and the aircraft's sensor capability to determine the range at which targets may be recognized and acquired. The

EOTDA program is available to air reconnaissance planners and aircrew via the local weather office (Note: Certain modules of the EOTDA program are classified).

THEATER BATTLE MANAGEMENT CORE SYSTEM (TBMCS)

TBMCS is a battle management system that will be used for planning and executing air operations in the future and is designed to replace the contingency theater automated planning system (CTAPS). TBMCS provides a complete tool kit to manage and plan the overall war and the daily air war. TBMCS is an Air Force-developed program formed by the consolidation of several existing segments; CTAPS, combat intelligence system, and the wing command and control system. CTAPS is used to plan and execute air operations. The combat intelligence system is used to optimize component and unit-level intelligence functions and to provide the warfighter with the most accurate and timely intelligence data available. The wing command and control system is an Air Force application used to provide a secure, accurate, timely, and automated system affording a composite view of command and control information for wing commanders and their battlestaffs. The wing command and control system supports effective decision making during exercises and operational contingencies. These systems implement a consistent software architecture that integrates the flow of information among them. TBMCS will be a joint system that can be used to:

- Build the target nomination list, the air battle plan, and the air tasking order (ATO).

- Monitor the execution of the air battle and adjust, as required.

- Plan routes, ensure airspace deconfliction.

- Build the airspace control order.

- Provide weather support.

- Manage resources (e.g., aircraft, sensors, weapons, fuel, and logistics).

- Gather information on the enemy, battle results, and friendly forces.

- Analyze information to determine strategies and constraints.

- Identify potential air reconnaissance areas and targets, and propose an optimal sensor mix.

- Provide for support and protection of ground forces.

- Plan countermeasures and frequency assignments.

The Marine Corps plans to purchase only the CTAPS equivalent functionality and the targeting and weaponeering module within combat intelligence system. The wing command and control system segment will not be used by the Marine Corps. See MCWP 3-25.4, *Marine Tactical Air Command Center Handbook*, for more detailed information on TBMCS and CTAPS.

SUMMARY

Paving the way for successful air reconnaissance execution is thorough planning. Commanders, staffs, and aircrews must be involved in all modes and levels of air reconnaissance planning by ensuring a constant flow of information vertically within the chain of command and laterally among staff sections. The OPT facilitates the integration of planning at the MAGTF, ACE, and aircrew levels.

The best chance for success is to keep the plan simple and execute it properly 100% of the time, rather than having the most elaborate plan that covers every contingency but has a greater chance for failure. Knowing the capabilities and limitations of air reconnaissance platforms, planners can effectively use air reconnaissance to collect information on the terrain, weather, hydrography, and enemy situation. Knowledge of the capabilities and limitations for air reconnaissance platforms and sensors enables planners to economically use the MAGTF's organic air reconnaissance assets while maximizing the chances for mission success.

Chapter 4

Execution

Decisionmaking in execution thus becomes a time-competitive process, and timeliness of decisions becomes essential to generating tempo. Timely decisions demand rapid thinking with consideration limited too essential factors. In such situations, we should spare no effort to accelerate our decision-making ability.

MCPP 1, Warfighting

Air reconnaissance operations provide the MAGTF commander with a rapid means to gain and maintain situational awareness to ever-changing conditions within the battlespace. Today, the MAGTF commander is faced with a potential battlespace that could span the entire spectrum of conflict, from military operations other than war (MOOTW) to major theater wars (MTW's).

The effective execution of air reconnaissance supports and depends upon the six warfighting functions; command and control, fires, maneuver, intelligence, force protection, and logistics. The key to executing air reconnaissance operations is to provide fast, reliable, and accurate information. Timely information obtained through air reconnaissance provides the MAGTF commander vital intelligence requirements that aid his decision making processes during the planning and execution phases of operations. This chapter addresses tactical considerations for commanders, controllers, operators, and aircrews in executing air reconnaissance operations.

Section I

Requirements

REQUESTING AND TASKING

Proper preparation and prompt submission of requests determine timely and effective air reconnaissance support. After determination that a battlefield situation or mission calls for air reconnaissance support, the request is submitted in the form of a written or voice request. Request formats translate information into a standard medium that the appropriate agency can process. An example JTAR/SR format is listed in appendix D. The requests are very specific in nature, and require clear and concise information from the requesting unit. The quality of air reconnaissance information received by the requesting unit is typically proportional to the quality of the request. Once the JTAR/SR request is completed, the request is submitted via voice or message format. The request is then processed and tasked for execution. When forces are deployed in the field, the requests for immediate air reconnaissance support are transmitted over the tactical air request (TAR) net to the DASC.

The MAGTF commander's guidance relating to aviation tasks will focus the efforts of commanders and staffs. The MAGTF commander decides the amount of air support that will be dedicated to air reconnaissance missions during the air apportionment process. The MAGTF commander's air apportionment decision is normally based on the recommendation of the ACE commander. The ACE commander processes the joint tactical air reconnaissance/surveillance requests (JTAR/S) submitted, then estimates the number of sorties required to provide air reconnaissance for the MAGTF. The ACE allots sorties for air reconnaissance based on the support required by the main effort, priorities of data collection for intelligence functions, and requests submitted by other units.

As preplanned requests are submitted and refined, as much information as possible concerning the supported unit commander's intent, scheme of maneuver, control measures, and fire support plan should be included. At a minimum, mission data will include mission number, call sign, number and type of aircraft, ordnance, estimated time on target (TOT)/time on station (TOS), CP, initial contact (whom aircrews contact first), and call sign and frequency of final control agency.

BASING MODES

Air reconnaissance aircraft may be operationally based in a number of ways. The more traditional basing modes include main operating bases on land and sea-basing aboard naval ships. Fixed-base and shipboard deployment generally offer the widest range of available ordnance, mission equipment, logistic support, and so on, but these locations are often well removed form the battle area. As a result, aircraft may have farther to fly to reach air reconnaissance target areas and have a longer turnaround time between missions. In addition to using main operating bases and ships, aircraft can be deployed to forward operating bases (FOB's). Forward deployment of air reconnaissance aircraft offers several advantages. Operating from locations close to the battle area can increase loiter time in the objective area, extend effective combat radius, and perhaps most importantly, make air reconnaissance more responsive to ground commanders by shortening the response time. Preplanned logistic support is vital to ensure that sufficient ammunition, fuel, and servicing equipment are in position and ready for use when needed. Forward arming and refueling points (FARP's) are another method of employing forward operating bases.

INTELLIGENCE

Intelligence provides continuous updated information to air reconnaissance operations prior to, during, and after mission execution. This information provides aircrews and operators situational awareness to information that may not have been available during mission planning. Updated intelligence should include enemy surface-to-air and air-to-air threats, capabilities, force dispositions, intentions, and vulnerabilities. Intelligence also provides air reconnaissance updated environmental assessments, such as the effects of adverse weather, darkness, and temperatures. Aircrews and operators should receive an updated intelligence brief prior to walking for each air reconnaissance mission. Aircrews and

operators receive and transmit updated intelligence information via the MACCS while airborne. Upon the completion of the mission, the first stopping point for aircrews and operators should be with the G-2/S-2 for an intelligence debriefing.

Enemy threat levels

To reap the benefits of air reconnaissance, aircrews and operators flying the mission must, for the most part, over fly the target to collect information. Although synthetic aperture radar assets have a stand off capability, enemy threat levels determine air reconnaissance feasibility and are depicted as low, medium, and high. There is no clear dividing line between the threat levels because air defense systems that present a low or medium threat level for one type of aircraft may present a high threat level for another. A medium threat level during daylight hours may be subdued to a low threat level at night.

Current intelligence updates the threat levels for air reconnaissance operations. Command and control requires accurate and timely intelligence updates to ensure effective air reconnaissance execution. A change in threat level may force an esscalation in mission risk which outweights increased fighter escort or SEAD support.

A change in threat level may also require a change in tactics. For example, if an air reconnaissance aircraft aborts due to a ZSU 23-4 in the target area, other air reconnaissance aircraft in the mission would flex from the primary medium altitude profile to a high altitude profile, in order to avoid the ZSU 23-4. This change in medium altitude tactics has taken the ZSU 23-4 from a medium threat to a low threat. Inversely, however, the target may be more difficult to acquire due to visual and/or sensor performance. Threat levels alone do not determine if an air reconnaissance mission should be flown. The final decision will be a compromise between mission risk assessment and the necessity for air reconnaissance information. See Multiple Command Manual 3-1, Vol. 2, *Threat Reference Guide and Countertactic*s, for a detailed discussion of threat air defense assessment and planning.

Low threat levels allow air reconnaissance operations to proceed without prohibitive interference. Aircrews are free to select tactics that ensure effective use of reconnaissance sensors and collection techniques. A low threat includes:
- Small arms and medium antiaircraft weapons.
- Limited optical acquisition AAA with no integrated fire control systems.

Medium threat levels allow acceptable exposure time of friendly aircraft to enemy air defenses. This threat level can restrict air reconnaissance flexibility in the immediate target/objective area. A medium threat environment includes:
- Limited radar or electro-optic acquisition capability not supported by fully integrated fire control systems.

- A fully integrated fire control system, which is degraded because of terrain, weather, or other factors.

High threat levels exist when the enemy has an air defense system that includes integrated fire control systems and electronic warfare capabilities. This threat level severely affects the ability to conduct air reconnaissance operations. A high threat environment can include:

- Integrated command and control systems.
- Mobile or strategic SAMs.
- Early warning radars / electronic warfare assets.
- Integrated AAA fire control systems.
- Interceptor aircraft.

MAGTF G-2/S-2

The MAGTF G-2/S-2 Collection management officer (CMO) creates and maintains the MAGTF visual reconnaissance and surveillance requirements list (VARSRL) based upon the MAGTF's PIR's and IR's. The VARSRL contains prioritized PIR's/IR's, indications, specific orders/requests, associated targets, associated NAI's, in-flight reporting requirements, and negative reporting requirements. The VARSRL is used to drive pre-mission briefing and post-mission debriefing. The VARSRL is forwarded daily to MAGTF G-3 for inclusion into the ATO SPINS. Any changes to the VARSRL are sent immediately to the ACE G-2/S-2. The MAGTF G-2/S-2 also requests the employment of organic ACE aircraft, and theater aircraft in support of air reconnaissance missions.

ACE

The ACE is responsible to ensure that aircrews and operators provide accurate and updated intelligence information to the maximum extent possible. The following are some of the responsibilities that the ACE will provide MAGTF intelligence collection agencies during and after the execution of air reconnaissance missions:

- Ensure video tape recording (VTR) systems are used the greatest extent possible to assist in the collection of battle damage assessment (BDA).
- Disseminate MAGTF PIR/IR's and NAI's to appropriate intelligence sections.
- Ensure aircrews are debriefed for tactical information, and forward all MISREPS to MAGTF G-2 IOC.
- Forward all in-flight reports to MAGTF G-2 IOC via the most expedient means.

MISSION

The ACE is tasked with providing MAGTF operations with the six functions of Marine aviation. Both mission requirements and aircraft capabilities will drive the types and numbers of aircraft required to accomplish air reconnaissance missions. Aircrew, as well as commanders and tactical air controllers, need to know how support requirements effect the execution of air reconnaissance missions. Mission planning identifies the threats and support requirements for air reconnaissance operations. Support requirements are tasked through the ATO and executed by the TACC. The TACC provides functional interface for employment of MAGTF aviation with joint and multinational support assets. Support requirements during air reconnaissance operations can consist of:

Fighter escort

Since there is no way that intelligence can predict where or when enemy fighters may attack, fighter escort aircraft provide protection for air reconnaissance aircraft. Fighter escort aircraft may provide one, or a combination of the following; close escort, detached escort, and/or combat air patrol (CAP). Close escort fighters maintain contact with air reconnaissance aircraft. This type of escort provides better situation awareness between the fighters and air reconnaissance aircraft, as well as the threat's position relative to them. Detached escort fighters are normally flown in front, or to the side, of the air reconnaissance aircraft to screen them from enemy fighters. CAP's provide air reconnaissance aircraft a fighter escort normally from a roving or fixed location in the battlespace. The CAP is positioned to act as a barrier between air reconnaissance aircraft and enemy fighters. Classified tactical manuals contain the strengths and weaknesses when utilizing these different types of fighter escort tactics when performing air reconnaissance operations. The following are some employment considerations:

- **Air reconnaissance aircraft self-defense capability.** Although many of today's air reconnaissance aircraft have a self-defense capability, providing a fighter escort will allow more time for aircrews to concentrate on air reconnaissance tactics while the fighter escort aircraft focus on sanitizing the battlespace for air-to-air threats. When air reconnaissance aircraft provide their own self-defense, they are typically less effective due to more time taken away from the primary mission, and have higher fuel consumption rates, decreased maneuverability, and reduced air-to-air ordnance loads when carrying air reconnaissance sensors and air-to-ground ordnance.

- **Enemy air defenses.** If air reconnaissance aircraft are exposed to enemy air defense systems, it is more than likely that the fighter escort aircraft may be exposed to the same threat. SEAD support may only be sufficient to provide air reconnaissance aircraft protection from the threat. Therefore, the fighter escort aircraft may have to avoid the threat, which may make them less effective as fighter escorts.

- **Rules of engagement (ROE).** ROE may limit or prohibit the circumstances under which beyond visual range (BVR) missiles may be employed against enemy aircraft. Under very restrictive ROE, mission commander's and planners need to weigh the advantages and disadvantages of having close escort or CAP assets to provide fighter support.

Electronic warfare (EW)

EW aircraft protect air reconnaissance aircraft through electronic jamming and deception. Electronic jamming denies or disrupts the enemy's ability to detect or track air reconnaissance aircraft electronically. Electronic deception sends misleading information about the air reconnaissance aircraft's speed, altitude, size, and direction. EW requires detailed integration and coordination to protect air reconnaissance aircraft exposed to enemy threat air defenses. EW aircraft may be tasked with an airborne alert to provide on-call or reactive EW support for air reconnaissance aircraft. The following are some considerations for EW support during air reconnaissance operations:

- Preemptive EW is superior to reactive EW.
- Tactics and electronic countermeasures to be employed for unanticipated threats.
- Tactics and standard operating procedures (SOPs) in order to simplify EW coordination with air reconnaissance assets.
- The length of time EW support is available for air reconnaissance aircraft.
- Enemy fighters capability to degrade EW support.
- EW interference with communication, command and control systems, and aircraft weapon systems and EW suites.

Suppression of enemy air defense (SEAD)

SEAD provides force protection for air reconnaissance aircraft by degrading the effectiveness of enemy air defense systems. SEAD uses supporting arms (i.e., artillery, naval gunfire, and aircraft) along with other available means (i.e. GCE or EW) to suppress, neutralize, or destroy enemy air defenses. SEAD is integrated with not only air reconnaissance aircraft, but also with other supporting aircraft included in air reconnaissance missions. SEAD aircraft equipped with high-speed antiradiation missiles (HARM's) are typically targeted against enemy air defense early warning, targeting, and fire control radars. The following are some SEAD fundamentals required to support air reconnaissance aircraft:

- SEAD effects are short-lived and air reconnaissance aircraft need to minimize their time exposed to enemy air defenses.
- Adhere to air reconnaissance aircraft's routing of flight and timing to maximize SEAD effects.
- SEAD is a suppression tactic, not a destruction tactic for enemy air defenses.
- **Preemptive** SEAD provides the best protection for air reconnaissance aircraft.
- Limited SEAD weapons may require **reactive** SEAD tactics.

Air refueling

Air refueling support requirements depend upon mission specifics for air reconnaissance aircraft. In-flight refueling is required when targets and operating areas are far from the air reconnaissance aircraft's operating bases and will be typically annotated on the ATO. Air refueling may also be required to provide extended time on station for an airborne alert, or when aircraft are diverted from another mission to provide the MAGTF with an air reconnaissance capability.

Deception

Deception techniques can be used against enemy radars, communications intelligence (COMINT) sites, and other enemy assets. Effectively executed deception tactics draw the enemy's interest and forces away from air reconnaissance aircraft and its intended target area. Some deception techniques are listed below:

- Chaff corridor to deny enemy radar operator's coverage.
- EW techniques to present false targets to enemy radars.
- Use aircraft to make misleading transmissions to deceive enemy COMINT sites.
- Decoy aircraft or drones are used to pose a threat from a different direction than the actual route for the air reconnaissance aircraft.
- Preemptive changes in altitude and heading to avoid enemy air defenses.

DISSEMINATION

When aircrews and operators collect in-flight information (visual, imagery, and electronic), they can establish direct radio contact with other air and ground elements and disseminate combat information in a near-real-time, via the INFLIGHTREP (see appendix E). After landing, aircrews should debrief as soon as possible with the squadron's intelligence section (S-2) to complete the MISREP (see appendix F). This allows for timely dissemination to higher, adjacent, and subordinate commands of the air reconnaissance information that aircrew acquired during their mission while it is still fresh in their memory. The squadron's intelligence section extracts raw data from aircrews, and imagery and tapes recorded during the mission for submission in the MISREP. The collected information is also combined with other intelligence sources to provide the best intelligent picture as possible. All INFLTREP's and MISREP's will be forwarded via the ACE tactical air command center (TACC) to MAGTF G-2 Intelligence Operations Center (IOC). Increased efficiency due to technological developments in fiber optic, data link, and computer systems in the future will decrease the amount of time requesting units are able to access required air reconnaissance information. See MCWP 6-2, *MAGTF Command and Control*, and MCWP 6-22, *Communications and Information Systems*, for more information on dissemination of air reconnaissance information.

ATARS information is disseminated airborne via the F/A-18D's data link pod to the TEG; providing near-real-time imagery information in support of the MAGTF. The SGS, via an adhoc system over the SIPRNET, is another method to exploit ATARS information post mission. The SRIG or G-2/S-2 then disseminates the information to the requesting ground and air units.

TERPES is used post mission to process and disseminate EW data collected by the EA-6B's. This system translates rapidly the machine-readable, airborne-collected digital data into man- and machine-readable reports (i.e., paper, magnetic tape, secure voice, plots, and over-lays).

The VMU may conduct limited imagery exploitation or analysis. Generally UAV imagery is screened by VMU imagery analysts for information of immediate tactical value in accordance with the intelligence collection and reporting criteria stipulated by the ISC or the supported unit's intelligence officer. INFLIGHTREP's can pass the information that does not necessarily require imagery, cutting down response time to the customer. Imagery can also be feed to a Remote Receive Station, provided that station is within 30km of the UAV. The horn antenna of the RSS receives the signal from the UAV and the images are then viewed real-time on the CRT screen. Imagery reproduction can be printed out from the UAV video, and subsequently hand carried to the customer. Imagery tapes, either one-half or three-quarter in format, are delivered by VMU to the IIP for further detailed post flight imagery analysis. For ease of dissemination, images can be video captured and transmitted digitally as a computer file.

Section II

Capabilities and Limitations

CAPABILITIES

Controllers, operators, and aircrews must be familiar with the capabilities of aviation assets to meet the required requests and tasking to collect air reconnaissance information. The following are generic guidelines for all categories of air reconnaissance.

Battlefield surveillance

Battlefield surveillance is the systematic observation of the battle area for the purpose of providing timely information and combat intelligence (Joint Pub 1-02). Battlefield surveillance is effective for counterinsurgency tactics or in the early stages of any operation where the situation is not fully developed. Battlefield surveillance is generic in nature and does not concentrate its focus on a particular area.

Area reconnaissance

Area reconnaissance covers a general area, monitors movement, and detects military activities. The requesting agency determines search area limits, and aircrews determine flight plans to ensure target coverage. Generally these collections work in concert the MAGFT's TAI's and NAI's. Area reconnaissance is especially effective when the same aircrew survey the same AOR on a daily basis; consistency allows the aircrew to monitor small or gradual changes that maybe overlooked by different crews each day.

Specific reconnaissance

Specific reconnaissance detects military, paramilitary, or suspicious civilian activity within suspected or known locations. Employ specific reconnaissance for point targets and selective information. Specific reconnaissance includes observation of airfields, suspected enemy air defense assets, and logistic depots to determine enemy size or specific traffic patterns.

Route reconnaissance

Route reconnaissance is a visual observation over enemy lines of communication, along planned avenues of approach, or over friendly routes of communication that are subject to enemy interdiction. Roads are most often associated with route reconnaissance, but rail lines and rivers can also be included. Route reconnaissance also determines the trafficability of these lines for future friendly operations as well. Route reconnaissance is performed on a point-to-point or town-to-town basis over a pre-selected route.

Helicopter landing zone reconnaissance

Helicopter landing zone (HLZ) reconnaissance determines location, characteristics, capacity, suitability, and hazards of potential HLZs. Conduct HLZ reconnaissance sporadically and in a deceptive manner to prevent disclosure of future intentions.

Terrain analysis

Terrain analysis provides commanders with information on which to base a concept of operation, devise schemes of maneuver, and develop logistics plans. Terrain analysis locates and identifies ground forms, ground covers, and natural obstacles.

Map correction

Map correction missions update existing maps and air photo-mosaics. It clearly defines locations to ease map correction, and identifies locations to facilitate comparison of actual terrain features with maps.

Bomb hit assessment (BHA)

BHA is the determination of the effects of attacks on targets. These missions either provide information on prior air strikes for the future targeting cell or the immediate effects of current missions or supporting arms fire. Identifying and reporting remaining enemy assets still on the battlefield is just as important as reporting what has been destroyed.

Observation of ship-to-shore movement

Aircrews provide command elements with continuous information on the progress of surface craft and helicopter waves during amphibious landings. These aircraft can also provide critical communication liaison for missions that are operating over the horizon.

Supporting arms coordination

Certain squadrons organic within the MAGTF are capable of coordinating and adjusting supporting arms; to include artillery, air, and naval surface fire support. HMLA, VMFA(AW), and VMU are trained and equipped to conduct supporting arms coordination.

Flexibility

All MAGTF aircraft are capable of performing air reconnaissance. The operational art for a commander is to train aircrew and make air reconnaissance an inherent part of every mission.

LIMITATIONS

As well as knowing the capabilities of air reconnaissance aircraft, controllers, operators, and aircrews must be familiar with the limitations of aviation assets to meet the required requests and tasking to collect air reconnaissance information. The following are generic guidelines for all categories of air reconnaissance.

Visual limitation

The human eyeball is deficient in its ability to detect objects from increased slant range/angles and high track crossing rates. Also, **identifying** targets during hours of darkness is a challenge, but **detection** is improved with NVD's.

Enemy threat levels

A higher threat level generally decreases the accessibility and quality of air reconnaissance.

Weather / Environment

Weather is a major factor that influences air reconnaissance tactics. Weather at the target area makes identification difficult and may change the positioning, altitude, and slant angles of air reconnaissance profiles to accomplish the mission. Low ceilings and poor visibility decrease air reconnaissance effectiveness and will possibly abort the entire mission. Battlefield obscurations (smoke, fire, debris) pose the same limitations as bad weather. See chapter 3 for detailed discussion of weather / environment effects on air reconnaissance operations.

Priority

What is the response time and who needs the information? The biggest factor is the distance to the target area. If aviation assets are already airborne, the possibility exists to divert aircraft from another mission. However, generating a new mission takes time to plan, collect, process, and disseminate.

Aircrew proficiency

Knowledge and understanding of an enemy's tactical formations and make up should become an element of all aircrews repertoire. Visual search techniques, visual cues, and experience are all factors in determining the accuracy and completeness of air reconnaissance information. Quantity of information does not always compensate for quality of information.

Command & control

To maximize air reconnaissance, airspace coordination and airspace control measures must be integrated and deconflicted within the ATO. See MCWP 3-25, *Control of Aircraft and Missiles.*

Combat radius

This will affect the ability of some assets to collect any near real time information. Aircraft time on station / combat radius is dependent on target distant factors and tanker availability. An increase of time on station by aerial refueling reduces this limitation, but requires additional planning and coordination.

Communication

Real time information is crucial to maintaining good situational awareness. Communication plans should either provide for secure voice transmissions or provide codewords to pass information in the clear. It is important not to compromise any information to the enemy because of undisciplined airborne communications.

Enemy camouflage, concealment, and deception (CCD)

If the enemy is skillful in the art of CCD, aircrew should be extremely cautious of overly obvious sightings. This lack of camouflage may be a deception technique used to lure VR aircraft into AAA or SAM engagement zones. The enemy may also destroy or provide false targets to deceive accurate battle damage assessment (BDA).

Section III

Visual Reconnaissance

Visual reconnaissance (VR) is generally described as any airborne activity used primarily for detection and gathering of timely intelligence information that will aid in the conduct of military operations. Historically, visual reconnaissance has proven to be one of the major factors in determining who wins on the battlefield; the French successfully used VR in 1793 and it continues to be a force multiplier today. Although VR seems simplistic in theory, the concept is sometimes neglected, but if combined to work in concert with other intelligence assets, (ground reconnaissance, HUMINT, IMINT, SIGINT) air reconnaissance becomes a critical capability to maintain situational awareness on the battlefield. Commanders must be aware of the VR capabilities/limitations and emphasize the importance that VR plays in the MAGTF's intelligence collection plan and supporting arms coordination.

ASSETS AVAILABLE

Any MAGTF aviation unit or type of aircraft can perform visual reconnaissance; however, supporting arms coordination requires specialized training and is performed specifically by HMLA, VMFA(AW), and VMU. Aircrews must be cognizant of the need to report all information concerning enemy activity. Although a sortie on the ATO may not indicate a dedicated air reconnaissance mission, aircrews must understand the implied intent of visual reconnaissance in each aviation sortie and strive to absorb and report as much information as possible. (Refer to appendices A and B for a detailed breakdown of assets and missions).

Binoculars are essential factors that increase the capability of day VR. They give aircrew a better perspective on objects within a target area, especially when increase stand off is required because of threats. NVD's provide VR assets the ability to exploit night operations and dramatically increase the chances of detecting an enemy who employs poor light discipline.

SUPPORT REQUIREMENTS

Visual reconnaissance operations do not require specialized support equipment. Communications plans provide secure voice transmissions (INFLIGHTREP), message traffic (MISREP's), or face-to-face liaison to meet the requirements of disseminating visual reconnaissance information.

Section IV

Imagery Reconnaissance

The image format justifies all other types of reconnaissance into a visual picture that the human mind can process. The detail and situational awareness gleaned from a picture supports the old saying, "a picture is worth a thousand words."

In the Marine Corps, we have been without a manned tactical imagery reconnaissance platform for over a decade. The last aircraft, retired in 1990, was the RF-4B. Today, technology fills this critical gap with new digital and electro-optical assets proven to pave the way for battlefield dominance. Commanders must still rely on timely, accurate information in order to seize the initiative, maintain tempo, and exploit success on the battlefield. The old battle tested techniques of image reconnaissance are still valid and useful, but it is the new technologies, like the FA-18D's ATARS, that are providing the seamless transition into a new age of air reconnaissance.

Imagery Reconnaissance and is broken down into two subsets, optical and non-optical. Current optical imagery sensors include 35mm photography film, digital cameras, television, and electro-optical sensors, such as the ATARS LAEO and MAEO sensors that scan an optical image. Non-optical imagery assets include infrared (IR) and synthetic aperture radar (SAR). Imagery reconnaissance equipment, such as ATARS, can produce near real time intelligence when transmitted via data link to ground units, but the majority of systems organic to the MAGTF still require aircraft to land prior to processing the reconnaissance information.

OPTICAL IMAGERY

Optical imagery is obtained during daylight only, and may be taken by hand held 35mm cameras and digital cameras or onboard strike cameras (KB-35 strike camera on the F/A-18). Digital cameras have been used successful by VMFA (AW) squadrons in Bosnia, and the 22nd MEU in Somalia. Photographs are divided into different orientations to maximize their utility as an intelligence tool (see figure 4-1).
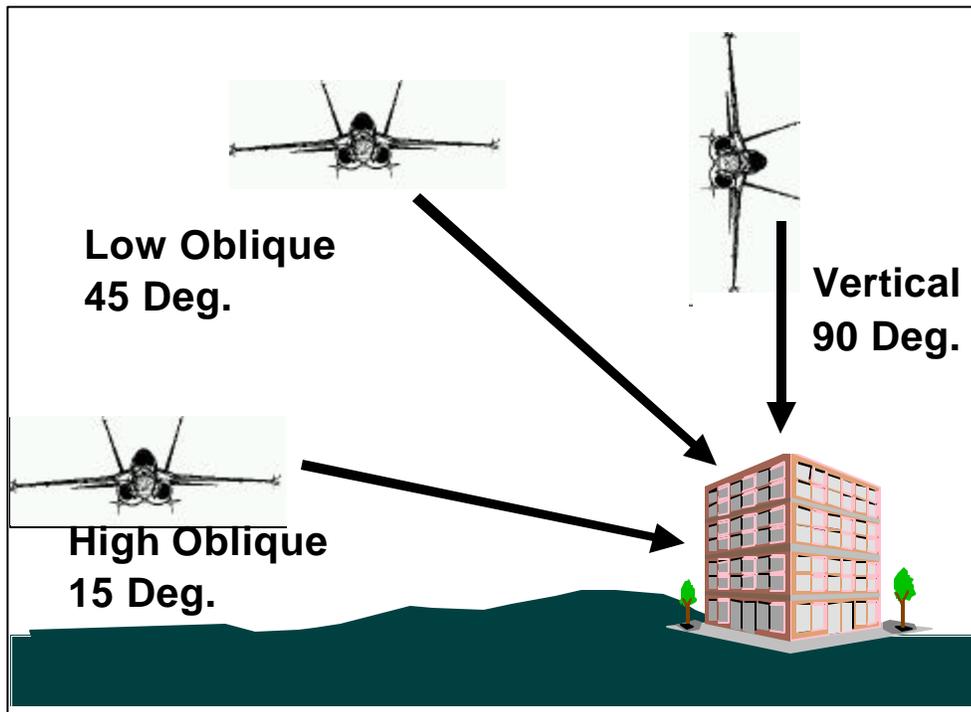
Imagery Orientation
Figure 4-1

Vertical sensor coverage

Vertical sensor coverage is taken with the sensor's axis perpendicular to the earth's surface. This produces a scale that is constant throughout the print unless there is a wide variation in an area's elevation. Use vertical sensor coverage to obtain precise measurements. Vertical coverage is divided into pinpoint, strip, and area/panoramic coverage.

• **Pinpoint coverage** is a single, vertical print, which covers a specific target. Use pinpoint coverage where depth measurement is not required. It is used to pinpoint small critical areas (e.g., bridges, buildings, and troop concentrations) for precise study.

• **Strip coverage** consists of overlapping prints along a flight path. Prints are usually taken at a constant altitude. Coverage is normally of long, narrow targets (e.g., lines of communication, lines of contact, beaches, and helicopter approach and retirement routes).

• **Area/Panoramic coverage** is used when an area cannot be covered at the desired scale using a single vertical strip. Area coverage employs a system of parallel strips that are merged together

once developed. It is performed by one or more aircraft using the same or different sensors and can be performed at the same or different times. These images do not have a constant scale, so it is very difficult to take measurements; however, the center of the image provides a more accurate measurement than its perimeter. Area/panoramic imagery is extremely useful in search operations (scanning from horizon-to-horizon for new targets). If scale requirements are not critical, area/panoramic coverage vice multi-strip coverage is the preferred method of imaging large area targets (see figure 4-2).
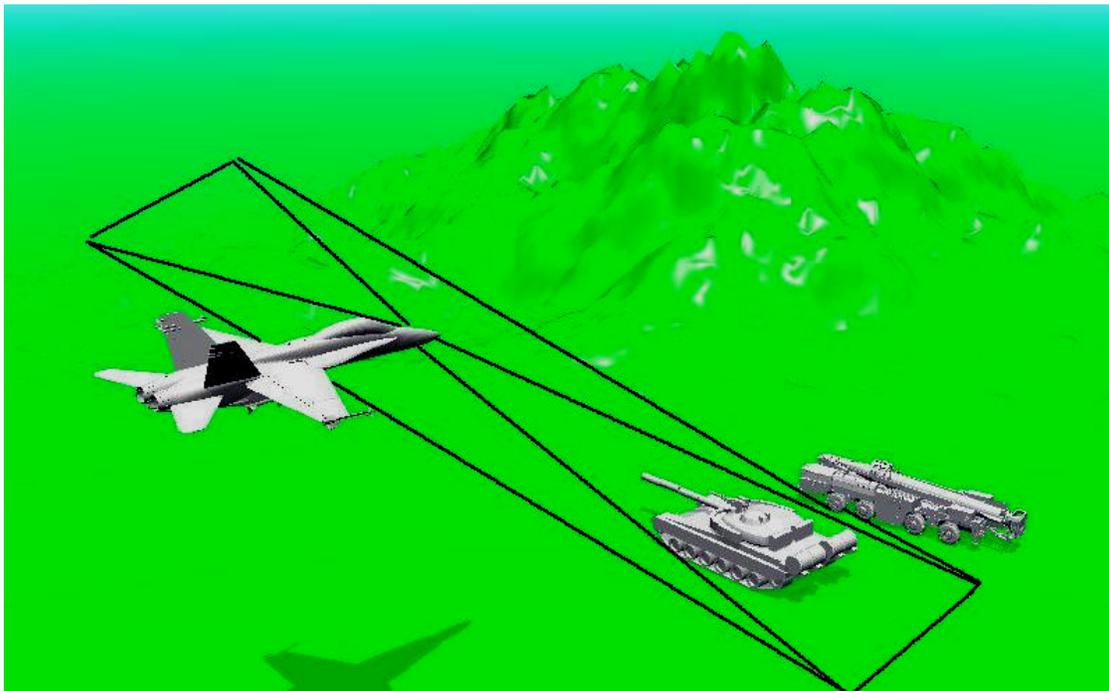
Area/Panoramic coverage
Figure 4-2

Oblique sensor coverage

Oblique sensor coverage tilts the axis of the sensor away from the vertical to obtain oblique sensor coverage. It can reveal objects that are camouflaged from overhead detection and do not require the aircraft to fly directly overhead the target. This reduces the possibility of aircraft loss due to enemy air defenses. Angular distortions make precise measurements difficult. Oblique imagery can be taken at high or low oblique angles (see figure 4-1).

Electro-optical imagery

Electro-optical imaging devices monitor the electromagnetic spectrum form the ultraviolet (0.01 micrometers) through the far infrared (1,000 micrometers). Portrayal methods include a scope presentation for instantaneous viewing and imagery recording via the aircraft's video tape recording (VTR) system. EO sensors may be pod mounted or integral to the aircraft/UAV and are usually direct view optics sensors. EO sensors have day capabilities and do not require processing in order to be viewed for analysis of intelligence information.

Daylight only EO sensors vary in form ranging from digital sensors imbedded in the ATARS, to television type sensors. Imagery provided by the ATARS on F/A-18D's can be recorded in "tape" format or transmitted via data link to the TEG in providing near-real-time digital imagery. Digital imagery produced through the ATARS can provide the same coverages as photographic imagery: vertical, pinpoint, strip, area and orientation coverages. The charged coupled device (CCD) low light level television (LLLTV) on AH-1W *Cobras*, angle rate bombing system (ARBS) on AV-8B *Harriers*, and day sensor on the Pioneer UAV are three types of television sensors employed in air reconnaissance missions. Some weapons also possess the capability to acquire EO imagery information while mounted on the aircraft and can data link imagery to the aircraft after weapon's release. Weapons such as the *Walleye* and U.S. Air Force's GBU-15 are capable of providing EO imagery on scope presentation for aircrews to detect, identify, and attack targets, and record imagery information.

NON-OPTICAL IMAGERY

Non-optical imagery can be obtained during both day and night operations by IR and SAR imaging systems.

Infrared (IR) imagery

Infrared (IR) Imagery is produced as a result of sensing electromagnetic radiation's emitted or reflected from a given target surface in the infrared position of the electromagnetic spectrum (approximately 0.72 to 1000 microns). (Joint Pub 1-02) Infrared imagery collects emitted energy based on temperature and is effective in periods of **darkness or reduced visibility**. Portrayal methods include a scope presentation for instantaneous viewing and imagery recording on tapes for later use. Infrared sensors may be pod mounted or integral to the aircraft/UAV, and are usually called forward looking infrared (FLIR) devices. The ATARS and *Pioneer* UAV allow information to be transmitted to ground stations for dissemination and analysis. Weapons with IR seeker heads, such as the AGM-65F *Maverick* (prior to employment) and the AGM-84E *SLAM* (prior to weapon impact), are two types of IR weapons that are capable of displaying a scope presentation for aircrew to detect, identify, and attack targets, and record imagery information.

Radar imagery

Radar imagery is produced by recording radar waves reflected by recording waves reflected from a given target source. (Joint Pub 1-02) The synthetic aperture radar (SAR) of the F/A-18 and AV-8 in the air-to ground mode is a valuable aid in locating targets and surveying areas of interest 24 hours a day and in all weather conditions. The F/A-18 and AV-8 can record this radar imagery via video tape recording systems for later dissemination and analysis. The imaging is conducted to one side of the aircraft, either in a strip or spotlight map mode. See figure 4-3.
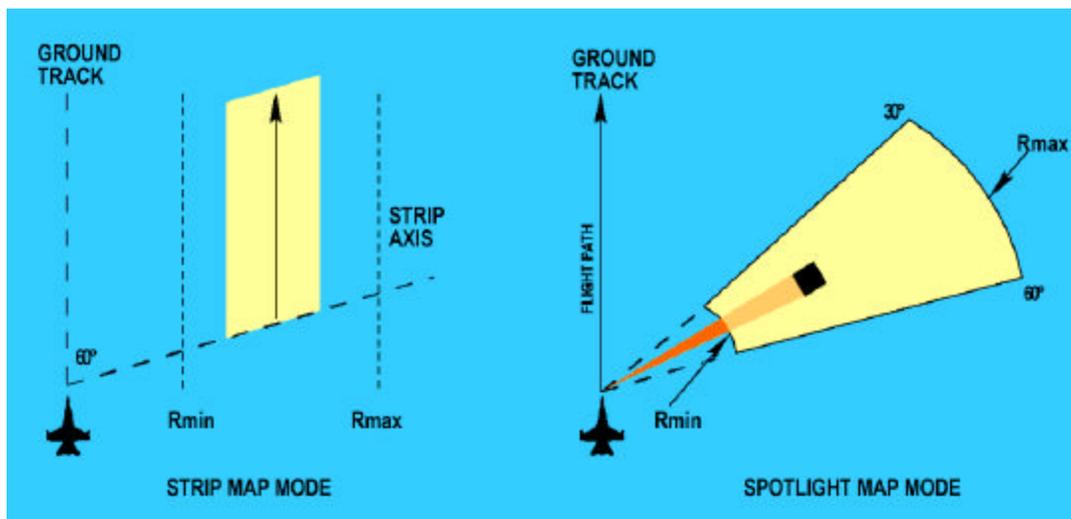
SAR Strip and Spot Light Modes
Figure 4-3

ASSETS AVAILABLE

HMLA, HMH, VMA, VMFA, VMFA(AW), and VMU squadrons within the MAGTF are capable of conducting imagery reconnaissance. Aircrews must be cognizant of the need to report all information concerning enemy activity as in visual reconnaissance INFLIGHTREP's and MISREP's. The only air reconnaissance platforms capable of transmitting real-time imagery information within the MAGTF are F/A-18D's equipped with ATARS in VMFA(AW) squadrons and *Pioneer* UAV's in VMU squadrons units. The following squadrons are listed to provide a general capabilities / limitations for collecting imagery information.

Marine Light/Attack Helicopter Squadron (HMLA)

HMLA squadrons have some very capable reconnaissance capabilities. The Telescopic Sight Unit (TSU) on the AH-1W *"Cobras"* is a day-only TV system capable of 5 to 13 times magnification. The Night Targeting System (NTS) on the Cobra has the capability of infrared and low-light TV sensors.

The NTS has multiple magnification capabilities from 2 to 50 times magnification depending on the system. This information is recorded on a standard SVHS or VHS tape. The UH-1 *"Huey"* has the Navigation Thermal Imaging System (NTIS). This system has selectable 1:1 or 10:1 fields of view. This imagery is recorded on VHS tapes. HMLA's use of digital cameras provided valuable combat information during operations in Somalia. Aircrews were able to collect information on the warring factions that proved valuable in future operational planning.

Marine Medium Helicopter Squadron (HMM) and Marine Heavy Helicopter Squadron (HMH)

HMM and HMH squadrons perform image reconnaissance with hand held cameras. As an example, when the Amphibious Ready Group (ARG) moved off the coast of Somalia prior to the insertion of ground forces, Marine helicopters with hand-held cameras provided the majority of the imagery for the MEU before Marines went ashore. Some CH-53E's are equipped with a FLIR system that can be viewed by aircrews; however, is not currently capable of being recorded.

Marine Attack Squadron (VMA)

VMA squadrons are comprised of three different types of AV-8B *"Harriers."* The day attack Harrier has an angle rate bombing system (ARBS). The ARBS is a day-only system, capable of six time's magnification, slewable 35 degrees either side of the nose and from zero to 70 degrees depression angle. The HUD may be recorded by an on-board VTR system. An important limitation of the AV-8B is that the 8mm tapes are recorded on a propriety recording system that can only be viewed by a specific player located in the *"Harrier"* squadrons. The night attack has the same systems, but adds the capability of a navigational FLIR, again slaved to aircraft boresight. The radar variant loses the capability of the ARBS in the nose to due to its radome required with the APG-65 radar in the aircraft.

Marine Fighter Attack Squadron (VMFA)

VMFA Squadrons, as well as VMFA(AW) squadrons, have the Laser Detector (LDT) pod which in itself has no air reconnaissance capabilities, but in the aft end of the LDT is the KB-35A Strike Camera. The KB-35A is a 35mm-film, 50mm lens system that is commanded by the mission computers to record the target from four seconds prior to ten seconds after computed bomb impact. This camera is slaved to the target and cannot record any oblique imagery. The F/A-18 *"Hornet"* also has the infrared capabilities of the targeting FLIR and navigational FLIR that can supplement reconnaissance data. The targeting FLIR has one and three-and-one-half times magnification and is slewable by the aircrew. The navigation FLIR is projected at a 1:1 ratio onto either the HUD or a cockpit display and is boresighted to the longitudinal axis of the aircraft. The Hornet also carries weapon systems like the AGM-65F *"Maverick"* and AGM-84E *"SLAM,"* that are capable of importing imagery into the cockpit which is capable of being recorded by the aircraft's video tape recording (VTR) system. The

AGM-88 *"HARM"* is another weapon carried by the *"Hornet"* that is capable of providing aircrews electronic reconnaissance information. Aircrews in VMFA's are also capable of recording SAR imagery, from its APG-65 or APG-73 radars, and HUD video through the VTR system. The *"Hornet's"* air reconnaissance information is recorded onto either 8mm or ¾ inch tapes and must be viewed on an 860-line monitor.

Marine All-Weather Fighter Attack Squadron (VMFA(AW))

VMFA(AW) squadrons possess the same IR capabilities as VMFA squadrons with the addition of ATARS. ATARS is a digital imaging system incorporated into the gun bay located in the nose of the F/A-18D. The removal of the M-61 gun, incorporates electrical and mechanical configuration changes, modifies the nose heating/cooling system, and changes the nose profile by adding optical and infrared apertures for the sensor suite. The sensor suite consists of two electro optical sensors and an infrared sensor, usable in the low to medium altitude envelope. The low altitude electro-optical (LAEO) sensor (figure 4-4) and the medium altitude electro-optical (MAEO) sensor (figure 4-5) cannot be used simultaneously; however, either can be used simultaneously with the infrared line scanner (IRLS) sensor (figure 4-6). The IRLS provides a high-resolution picture-like thermograph by showing the differences in radiating thermal energy. A synthetic aperture radar (SAR) imaging capability exists with an upgrade to the APG-73 radar. The SAR provides imaging capability at long standoff ranges in either a strip imaging mode or spot imaging mode. Included in the nose with the sensors are two digital tape recorders for storing imagery, and a reconnaissance management set for controlling the system, processing, and formatting the data for recording and on-board playback and/or transmission to a ground station. A common data link (CDL) is contained in a separate pod for attachment to the centerline weapon station for those missions where data transmission airborne is required. Each VMFA(AW) will have four aircraft configured to be reconnaissance capable. The Marine Corps has funded a total of 19 sensor suites, 13 data link pods, and 7 SGS's for all six of its VMFA(AW)'s.
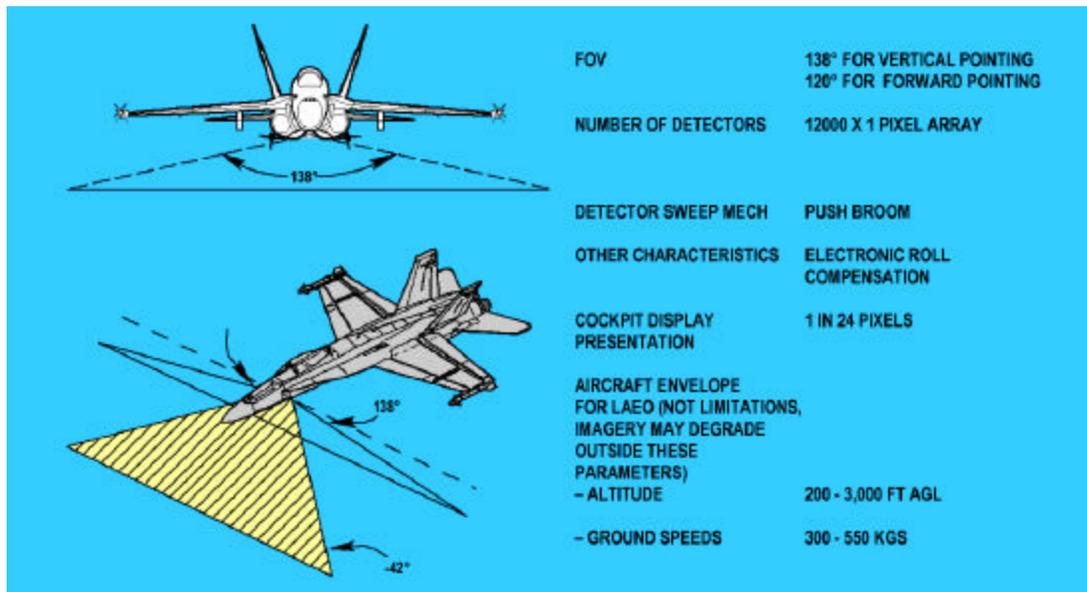
Low Altitude Electro-Optical (LAEO) Sensor Characteristics
Figure 4-4
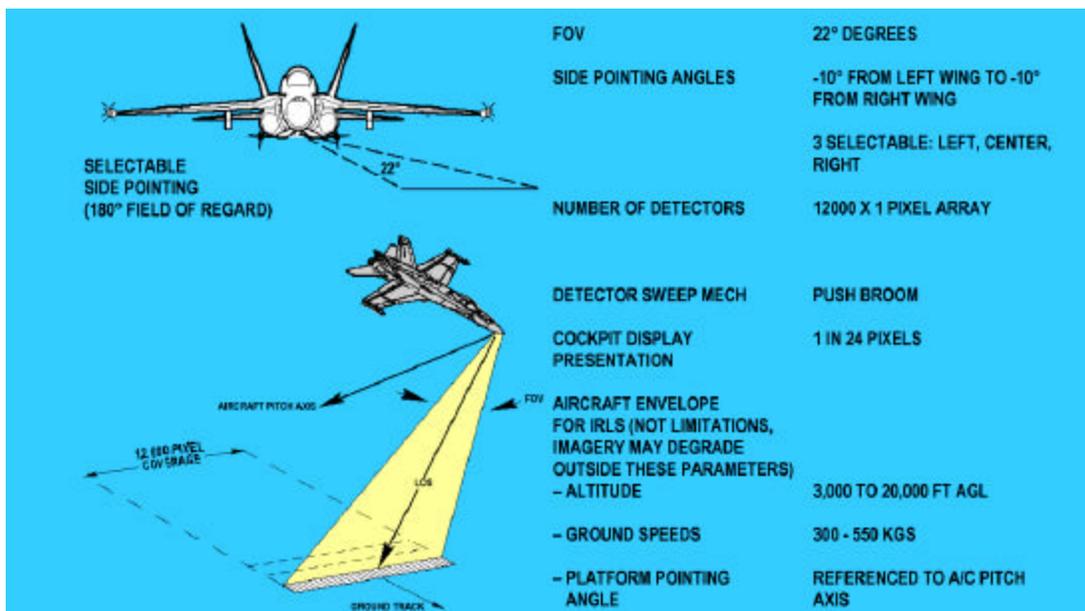
Medium Altitude Electro-Optical (MAEO) Sensor Characteristics
Figure 4-5

FOV   140° WIDE, 70° NARROW

FWD POINTING ANGLES   VERTICAL ONLY (-90°)

SIDE POINTING ANGLES   LEFT, RIGHT, VERTICAL
(ONLY AVAILABLE FOR
NARROW FOV)
– ELECTRONICALLY ROLL
  STABILIZER ± 30°

NUMBER OF DETECTORS   12 DETECTORS
                                     8102 PIXELS PER LINE
                                     1/4 TO 5 LINES PER SCAN

DETECTOR SWEEP MECH   IR LINE SCAN

AIRCRAFT ENVELOPE
FOR IRLS (NOT LIMITATIONS,
IMAGERY MAY DEGRADE
OUTSIDE THESE PARAMETERS)
– ALTITUDE   200 TO 3,000 FT AGL

– GROUND SPEEDS   300- 550 KGS

– NARROW FOV   MIN. ALT = 3.4 X KGS

                                     3000' FOR
                                     300 – 380 KGS
– WIDE FOV   MAX. ALT =
                                     2500' FOR
                                     380 – 550 KGS

70°
140°
NARROW
WIDE
FOV
8102 PIXEL COVERAGE
LOS
ROLL AXIS
SCAN DIRECTION
GROUND TRACK

Infrared Line Scanner (IRLS) Characteristics
Figure 4-6

Marine Unmanned Aerial Vehicle Squadron (VMU)

The VMU can support any size MAGTF, and its normal employment would be as an integral unit of the MAGTF's ACE in support of MAGTF operations. The squadron is also capable of limited independent operations. Each VMU has one system, consisting of five air vehicles and one ground control station (GCS). The RQ-2A, *"Pioneer,"* is a short-range, low altitude, unmanned aerial vehicle (UAV). The *"Pioneer"* is capable of being airborne for up to four hours, carries one of two payloads, operates up to 100 NM within LOS to the GCS, and requires an optimal sensor altitude from 3,000 to 5,000 feet above ground level. The MKD-200 is the day TV camera payload capable of detecting targets at 18km and recognizing or identifying targets at 3km. The MKD-400 is the FLIR sensor payload for the UAV. It will detect targets at 8km and recognize targets at 4km.

The *"Pioneer"* has limitations that must be considered when executing and planning missions. *"Pioneer"* limitations can be categorized into two broad areas: weather and support.

Weather directly affects the survival of the UAV when it is airborne, as it cannot fly through visible moisture or known icing conditions. Wind limitations for takeoff, landing, and while in flight, and altitude limits are:

- Headwind Limit: 25 knots, gusts to 30 knots
- Tailwind Limit: 5 knots (RATO and Pneumatic)
- Crosswind Limit: 15 knots, gusts to 20 knots
- Service Ceiling: 12,000 feet

Unlike manned aircraft squadrons, the VMU has significant support limitations. These include strategic lift, fuel, runways, and communications. The strategic lift footprint requires 3 C-5's and 5 C-141's to lift the squadron's aircraft, ground control equipment, mobile power supplies, rolling stock and personnel. The UAV's require unique fuel (100 low lead aviation gas), improved runway for operations (minimum of 688 ft x 50 ft), and line of sight communication between the GCS and the UAV.

The primary threat to *"Pioneer"* UAV operations is electromagnetic. Because the aircraft is radio controlled, this could be friendly interference or enemy attack. Primarily Electromagnetic Interference (EMI) comes from EA-6B's and Radio Frequency Interference (RFI) comes from TRC-170's. Threat Radio Electronic Combat capabilities must be considered when operating the Pioneer UAV. The radar cross-section and IR signature of the Pioneer are very small. Because of this small size, the UAV can become lost in clutter, or in the midst of other aircraft. Its slow speed also makes it more likely to be filtered out of most radar displays. Although advanced SAM's can potentially target the UAV, these factors mitigate their potential success. Although *"Pioneer"* has a loud auditory signature, it is difficult to acquire visually. AAA using barrage or curtain fire presents the highest probability of success for a surface to air threat to strike the UAV. Indirect fire on the ground control equipment is also a hazard, as the enemy can easily target it.

SUPPORT REQUIREMENTS

Together with communication and information system (CIS) resources supporting the MACCS, squadrons collecting imagery have sufficient CIS resources to support internal and squadron command and control, operations, and intelligence requirements. All squadrons will typically require access to various networks to conduct its operations, to include a secret internet protocol router network (SIRPNET) and a non-secure internet protocol router network (NIPRNET), as well as pertinent local area networks (LANs) and wide area networks (WAN's).

VMFA(AW) squadrons conducting ATARS missions will require support from the TEG to disseminate air reconnaissance information. The TEG is a ground-based imagery processing station being procured for the Marine Corps. This system consists of three Humvees with trailers and a tactical shelter (a tent) that are connected together into one single unit. The TEG is configured to receive and disseminate near-

real-time information data linked from ATARS aircraft. The ATARS EO and SAR imagery can also be accepted by the TEG via "tape" format recorded in-flight from the F/A-18D's DTR system. Aircrews and imagery analysts use the squadron ground station (SGS) to view EO, IR, and SAR imagery data upon completion of air reconnaissance missions. During Operation Allied Force in Kosovo, the SGS was required to transfer information recorded from ATARS tapes via an adhoc system in order to transmit the information over the SIRPNET so the JFC could receive the information. This was due to the TEG not being employed with the F/A-18 squadrons.   Logistical support also requires one C-141 to airlift just the ATARS support equipment, not including power supply/fuel and expeditionary communications (Trojan Spirit/TSC-93).

Marine squadrons have limited capabilities to process or reproduce photographic imagery. The ACE depends on naval support while afloat and the CSSE while ashore to process and reproduce most imagery. Ground support requirements include:

- Personnel to process and reproduce film.
- Film processing equipment.
- Darkroom area for film processing.
- Electrical power.
- Fresh water and waste disposal for photo processing.
- Transport of photo processing equipment and personnel.

Section V

Electronic Reconnaissance

Electronic reconnaissance detects, identifies, evaluates, and locates foreign electromagnetic radiations emanating from other than nuclear detonations or radioactive sources in the area of operations. (Joint Pub 1-02)   The Marine tactical electronic warfare squadron (VMAQ) is the MAGTF's primary aviation squadron tasked with executing electronic reconnaissance, however other MAGTF aviation assets also have limited electronic reconnaissance capabilities.

Aircraft conduct electronic reconnaissance during day, night, and all-weather conditions from standoff ranges. This allows aircraft to remain undetected, yet allows EW systems the ability to detect, identify, and locate enemy emitters. Information is recorded for evaluation, interpretation, and analysis in providing electronic intelligence. Electromagnetic radiations can be analyzed in-flight by aircrews in order to provide real-time electronic reconnaissance information to other aircraft and ground personnel. Electronic reconnaissance aircraft may be tasked with the following types of missions.

Tactical electronic reconnaissance allows the MAGTF to detect enemy electromagnetic radiations. Information gathered from aviation assets can be combined with other MAGTF information and external

sources to develop and update the enemy's electronic order of battle (EOB). F/A-18's can use the AGM-88 HARM as an electronic reconnaissance sensor to detect enemy electromagnetic radiations and record identified threats via its video tape recording (VTR) system and be analyzed in-flight and after landing.

Electronic Support Measure (ESM) is used to search for, intercept, identify, and locate sources of radiated electromagnetic energy for immediate threat recognition. ESM provides combat information required for immediate decisions involving electronic warfare, avoidance, targeting, and other tactical employment forces.

ASSETS AVAILABLE

The only true capable air reconnaissance platform in the MAGTF capable of searching for, intercepting, identifying, and locating sources of radiated electromagnetic energy for immediate threat recognition is the EA-6B *Prowler* of the VMAQ squadrons. The EA-6B's EW systems are used to detect, identify, and locate threat emitters. This is not to say that other MAGTF aviation assets cannot provide electronic reconnaissance information.   HMLA, HMH, HMM, VMA, VMFA, VMFA(AW), and VMGR squadrons within the MAGTF are also capable of acquiring electronic reconnaissance information in the battlespace. Threat warning receivers (EW systems) onboard these aircraft can provide aircrew with the direction of arrival and emitter type to aid in identifying enemy surface-to-air and air-to-air threats. The F/A-18 can also use the HARM as an electronic reconnaissance sensor. Aircrews must be cognizant of the need to report all information concerning enemy threat emitters by passing in-flight reports and completing mission reports post mission.

Marine Tactical Electronic Warfare Squadron (VMAQ)

VMAQ conducts electronic reconnaissance and ELINT operations to maintain electronic order of battle (EOB), to include both selected emitters parameters and location of nonfriendly emitters. VMAQ's also provide threat warnings for friendly aircraft, ships, and ground units. The ALQ-99 Tactical Jamming System effectively incorporates receivers and external pods for signals reception and transmission of jamming signals (principally associated with threat air defense radars and its associated C2). The EA-6B also employs the USQ-113 Communications Suite which provides the ability to collect, record, and disrupt threat communications and can either intercept and jam targeted signals of interest or intercept and digitally record signals of interest.   The EA-6B records electronic reconnaissance information on to a Raymond Recording System (RRS) tape (similar to an 8-track tape). This information can then be extracted using either the Tactical EA-6B Mission Planning System (TEAMS) or the Tactical Electronic Reconnaissance Processing Evaluation System (TERPES).

SUPPORT REQUIREMENTS

The technical electronics reconnaissance processing and evaluation system (TERPES) is an integrated, land-mobile, air-transportable data processing system organic to the Marine Tactical Electronic Warfare Squadron (VMAQ). The primary mission of the TERPES is to provide ground processing of EW information, including EW support (ES) and EW attack (EA), collected by EA-6B aircraft. TERPES supports VMAQ squadrons on deployments throughout the world, both land-based and carrier-based. The secondary mission is to provide electronic intelligence support to the MAGTF. See MCWP 2-15.2, *Signals Intelligence*, for more information on electronic reconnaissance in support of MAGTF operations.

<div align="center">

Section VI

Operations

JOINT AND MULTINATIONAL OPERATIONS

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Joint air operations are those air operations performed with air capabilities/forces made available by other service components in support of the JFC's operation or campaign objectives, or in support of other components of the joint force. The JFC has the authority to exercise operational control, assign missions, direct coordination among his subordinate commanders, redirect and organize his forces to ensure unity of effort in the accomplishment of his overall mission. The JFACC will use the JFC's guidance and authority, and coordinates with other assigned or supporting commanders. As a result, the MAGTF in joint and multinational operations may have air reconnaissance aircraft from both organic USMC direct support capabilities/forces and those capabilities/forces allocated to it by the JFACC. More information about air support in a joint force can be found in the following publications:

- Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*
- Joint Publication 3-0, *Doctrine for Joint Operations*
- Joint Publication 3-56.1, *Command and Control of Joint Air Operations*
- Joint Publication 3-09, *Doctrine for Joint Fire Support (Draft)*
- MCWP 3-25, *Control or Aircraft and Missiles*

Marine aviation forces capable of air reconnaissance in the joint environment are not exempted from JFC up-front tasking. The JFC may redirect MAGTF sorties for air defense, reconnaissance, and long-range air interdiction if he determines that they are required for higher priority missions other than for the MAGTF. The JFACC is the supported commander for the JFC's overall air reconnaissance effort.

MOOTW

Modern military operations are becoming increasingly involved in MOOTW. MOOTW focuses on deterring war, resolving conflict, promoting peace, and supporting civil authorities in response to domestic crises. As in a MTW, MOOTW's goals are to achieve national objectives as quickly as possible and to conclude the operations on terms that are favorable to the United States and its allies. As in all military operations, commanders will focus on a center of gravity in MOOTW. Air reconnaissance missions will be oriented to exert influence on the enemy's center of gravity. The MOOTW environment is unique in that it can transition quickly from combat to non-combat and back again and often has constraints on the forces, weapons, tactics employed, and the level of violence. Depending on the environment, mission, and location of MOOTW operations, the degree of control may need to be more rigorous and the rules of engagement may need to be more restrictive than for higher scale operations. Consequently, in MOOTW environments prone to such dynamic change, all air missions, including both fixed- and rotary-wing of all components, must appear on the appropriate ATO and/or flight plan. In addition, aircraft may have to monitor a common frequency and operate on designated identification friend or foe (IFF) modes and codes. Aircraft may operate without an ATO mission number in high-density aircraft environments, such as in a properly designated high-density airspace control zone (HIDACZ) or amphibious objective area published in the ACO. This type of rigorous control is necessary during such MOOTW because the mix of friendly, enemy, and neutral aircraft and mission constraints requires the commander to strictly control flights in the AOR/JOA (i.e., peace operations). The presence alone of air reconnaissance aircraft may be utilized by commanders to achieve their objectives in a MOOTW environment. See Joint Pub 3-07, *Joint Doctrine for Military Operations Other Than Wa*r, for more specific information on different types of MOOTW than those that are listed below:

- Arms control and combating terrorism
- DoD support to counter-drug operations
- Enforcement of sanctions/maritime intercept operations
- Enforcing exclusion zones
- Ensuring freedom of navigation and over-flight
- Humanitarian assistance
- Military support to civil authorities
- Nation assistance, support to counterinsurgency
- Noncombatant evacuation operations
- Peace operations
- Protection of shipping
- Recovery operations
- Show of force operations

- Strikes and raids
- Support to insurgency

AMPHIBIOUS OPERATIONS

These operations are an attack launched from the sea by naval and landing forces embarked on ships, involving a landing on a hostile or potentially hostile shore. The principal supporting arms in amphibious operations are aviation, naval gunfire, and artillery. There are four types of amphibious operations, each designed to have a specific impact on the adversary.

• **Amphibious Assault**. The principal type of amphibious operation. It involves establishing a force on a hostile or potentially hostile shore.

• **Amphibious Raid**. An amphibious operation involving a swift incursion into or the temporary occupation of an objective followed by a planned withdrawal.

• **Amphibious Demonstration**. An amphibious operation conducted for the purpose of deceiving the enemy through a show of force intended to delude the enemy into adopting a course of action unfavorable to him.

• **Amphibious withdrawal**. An amphibious operation involving the extraction of forces by sea in naval ships or craft from a hostile or potentially hostile shore.

Air reconnaissance operations needed to support an amphibious assault will be outlined in the air plan annex of the operations plan. Because air reconnaissance missions are usually in high demand during amphibious operations, the fire support plan should complement the use of aviation, naval gunfire, and artillery fires. Prior to D-day, air reconnaissance will largely be responsible for collecting information in the amphibious objective area and providing supporting arms coordination to shape the battlespace. Missions that air reconnaissance aircraft may perform in advance of the amphibious task force landing include collecting information on the intended landing area, helicopter landing zones, drop zones, and enemy forces, and observing and adjusting Naval gunfire. On D-day, air reconnaissance aircraft will be the primary supporting arms coordination for Naval gunfire for the landing force while artillery is moving ashore. Naval gunfire may be limited due to its range when employing STOM tactics from over the horizon. Post D-day, air reconnaissance operations will most likely consist of VR missions in support of tactical objectives, and DAS missions that shape the battlespace for subsequent operations. Air reconnaissance missions will be from aircraft capable ships when using OMFTS concepts. The air plan will be oriented toward missions that have the aircraft returning to the sea base for turn-around maintenance and crew changes, with the possibility of using FARP's ashore. The distance from the sea base to the objective and the aircraft endurance must be balanced against the required response time. Joint and coalition aircraft that are either land-based or carrier-based may augment air reconnaissance

missions. Their inclusion places responsibility on the MAGTF for ensuring good communications and coordination with air reconnaissance augmentation forces.

Amphibious raids are conducted as independent operations or in support of other operations, such as another landing, land campaign, or air or naval operation. Depending on the purpose of the raid, they may be conducted by stealth or appropriately supported so that they resemble the early stages of an amphibious assault. An amphibious raid is planned and executed in the same general manner as an amphibious assault, *except* a raid always includes provision for withdrawal of the raid force. Surprise is essential for the success of an amphibious raid. Therefore, air reconnaissance missions prior to a raid will most likely be limited to those few that are essential for success. Amphibious raids are well rehearsed, with limited objectives and of short duration. Therefore, fire support planning can be more detailed and of less volume than for that required for an amphibious assault. The need for surprise and the distance to the objective may conspire to make aviation fires the primary fire support for a raid. Using OMFTS concepts, STOM tactics lend themselves to amphibious raids especially when employing MV-22 aircraft from over the horizon. Air reconnaissance missions in this environment will be most useful when planned to provide information on critical targets and landing zone/objective for the landing force just prior to the raid. Air reconnaissance missions should be planned to be available for the duration of the raid, including the withdrawal.

The amphibious demonstration is intended to confuse the defender as to time, place, or strength of the main operation. An amphibious demonstration normally includes the approach of demonstration forces to the demonstration area, at least a part of the ship-to-shore movement, and employment of supporting fires. A brief but intense preliminary bombardment by naval gunfire will usually be the preferred fire support for a demonstration. Because of the requirement for the demonstration force to execute supporting fires of a nature and scope that ensures credibility, air reconnaissance missions may be conducted. However, the danger of losing an aircraft and crew, or capture of aircrew supporting an amphibious demonstration may curtail air reconnaissance missions in support of those operations.

Amphibious withdrawals are conducted to disengage forces for employment elsewhere. They may be conducted under enemy pressure or voluntarily. Withdrawal begins with establishment of defensive measures in the embarkation area and ends when all elements of the force have been extracted and embarked or re-embarked on designated shipping. With respect to air reconnaissance planning, amphibious withdrawals are characterized by having abridged planning processes, curtailed fire support means, and circumstances that may render it advisable to conduct the operations under adverse weather and limited visibility conditions. During an amphibious withdrawal, air reconnaissance missions will be instrumental in collecting information on deep targets, and covering the withdrawal of the heavy elements such as artillery and tanks. The withdrawal of heavy elements usually will take place under cover of darkness. The primary difference for fire support in an amphibious assault versus an amphibious withdrawal is that in the assault, supporting arms and control facilities are progressively built up ashore, whereas, in a withdrawal, supporting arms and control facilities are progressively decreased ashore until

all functions are performed afloat. Sea-based air reconnaissance assets will be vital in providing information on the enemy to the dwindling forces ashore.

SUMMARY

Air reconnaissance in the United States Marine Corps continues to provide MAGTF commanders with fast, reliable, and accurate intelligence information. In today's ever-changing battlespace, gaining and maintaining situational awareness is the key to victory. As the MAGTF commander expands his sphere of influence, air reconnaissance becomes one of the vital links to provide information in the deep, close, and rear areas of the battlespace. With its inherent strength to shape the battlefield, air reconnaissance provides visual, imagery, and electronic information collected on enemy locations, movement, and size in order for the MAGTF to fight the single battle. The real-time and near-real-time air reconnaissance capabilities organic to the MAGTF, allows commanders can make time sensitive decisions that maintain the initative and tempo of operations over the entire spectrum of conflict. This chapter has provided a general overview of air reconnaissance tactics, techniques, and procedures, and the MAGTF's aviation assets that employ them.

Chapter 5

Emerging Concepts and Capabilities

It is imperative that future air reconnaissance systems are capable of acquiring as well as disseminating information in a joint environment. The future systems will also be required to be responsive to a wide spectrum of end users. The concept of *Operational Maneuver from the Sea* provides the basic foundation for the requirements of Marine aviation's future role in terms of capabilities, operational employment, and joint relationships. These emerging concepts and capabilities for Marine aviation explore new implications for air reconnaissance to influence MAGTF operations.

OPERATIONAL MANEUVER FROM THE SEA (OMFTS)

In the white papers *From the Sea* and *Forward from the Sea*, the Navy and Marine Corps presented a common vision for a future which skillfully handled naval forces would enable the U.S. to exert its influence in the littoral regions of the world. Building on the foundation laid by these papers, OMFTS deals explicitly with the full spectrum of challenges the Marine Corps will have to face, not merely to amphibious operations but to all aspect of warfare in and around coastal waters. Key to the success of OMFTS is the need for timely and accurate air reconnaissance information. With respect to intelligence, OMFTS states, "The high tempo of operations essential to successful OMFTS requires that intelligence be provided to decisionmakers with a minimum of delay. Technology that permits the rapid dissemination of intelligence products will play an important role in this effort.

ADVANCED TARGETING FORWARD LOOKING INFRARED (ATFLIR)

The ATFLIR will replace three pods on the F/A-18: the targeting FLIR, the NAVFLIR, and the laser designator tracker (LDT). It will be used on all models of the F/A-18, including the F/A-18E/F. Incorporation for service use will begin in 2004. The ATFLIR, the world's first generation III targeting FLIR, was developed in response to a requirement for aircrews, and weapons and sensors officers to be able to acquire targets with improved target recognition and at greater standoff ranges. ATFLIR's magnification is 30X versus previous FLIR capability at 4X. The ATFLIR will provide autonomous precision targeting coordinates to "smart" weapons, such as joint standoff weapons (JSOW) and joint direct attack munitions (JDAM). As with the older FLIR on F/A-18's, the ATFLIR will not be integrated to the ATARS architecture, but will have reconnaissance usefulness, especially bomb damage assessment (BDA) and weapon impact assessment. The tape product of this sensor will also be used to assist reconnaissance imagery analysts with its improved resolution and reliability.

SHARED RECONNAISSANCE POD (SHARP)

The Navy is presently developing the SHARP reconnaissance system for the F/A-18E/F aircraft as a replacement for the TARPS beginning in 2003. SHARP will be fully contained within a pod, mounted on the centerline stores station. It will be a complete tactical reconnaissance system with a sensor suite consisting of either a separate medium altitude/medium standoff dual band sensor and a high altitude/long standoff, dual-band sensor or a combination medium altitude/high altitude/long standoff, dual band sensor. With separate sensors, only one can be carried at a time. The reconnaissance management set (RMS), solid state recorder and data link will be contained in the pod. The SHARP pod is required by Navy specifications to be compatible with installation on the centerline of the F/A-18C/D. The Marine Corps plans to procure the SHARP for the F/A-18C/D, with the high altitude/standoff sensor or the combination medium altitude/high altitude sensor, in sufficient numbers to bring both ATARS and SHARP to a total of 31 systems. In subsequent years, the Marine Corps will replace ATARS with SHARP according to the following procurement plan: FY04 – 12 pods, FY05 – 8 pods, FY06 – 8 pods. This will provide a total of 28 pods by 2008 to equip each F/A-18D squadron with four pods. Two will be provided to the Fleet Replacement Squadron in order to train incoming F/A-18D Weapon Systems Operators. The remaining two are required by the test community for continued performance refinements and future upgrades.

VERTICAL TAKEOFF AND LANDING UNMANNED AERIAL VEHICLE (VTUAV)

The VTUAV will replace the "Pioneer" for both the Navy and the Marine Corps. The VTUAV's speed, endurance, and payload carrying capability, combined with its ability to takeoff from and land on all air-capable naval ships and unimproved ground sites ashore, with provide a robust, multi-purpose unmanned platform in support of operational concepts and capabilities addressed in Forward from the Sea. Tactical control system (TCS) hardware and software, will provide a revolutionary capability to command and control all tactical UAV's and interface with a multitude of C4I systems. While initially designed to support reconnaissance, surveillance, and targeting missions, the utility of the VTUAV is expected to rapidly expand to other mission areas. These additional mission areas include communications and data relay; electronic warfare; nuclear, biological, and chemical sensing; and dispensing a range of material from chaff to sonobuoys.

The fielding of the VTUAV will not only replace the "Pioneer," it will represent a four-fold increase in the number of systems assigned to each VMU. The baseline, threshold modular mission payload (MMP) capability for the VTUAV will be an equipment package with EO and IR sensors and a laser designator. Other MMP are under consideration for possible future integration into the VTUAV. The VTUAV data link will support video, data, and telemetry communications among the air vehicle, the GCS, and the remote data terminal (RDT). The data link includes an air vehicle component, the air data terminal, and a ground component, the ground data terminal. The basic

VTUAV program will procure sufficient assets to support intelligence collection and targeting for sea operations, forward-based MEU's and MAGTF's.

TACTICAL CONTROL SYSTEM (TCS)

The TCS is the software and software-related hardware designed to support command and control of the Army's tactical unmanned air vehicle (TUAV), Navy and Marine Corps' VTUAV, Air Force's RQ-1 "Predator," and future UAV's. TCS will support interfaces with identified C4I systems and will be based on Service interoperability requirements specified by a common information infrastructure and common operating environment compliant GCS. TCS will permit the system to function from receipt and transmission of secondary imagery and data, to full control and operation of a UAV, including takeoff and landing.

JOINT STRIKE FIGHTER (JSF)

The JSF program will develop and deploy a family of strike aircraft by capitalizing on commonality and modularity to maximize affordability while addressing the needs of the Air Force, Navy, Marine Corps, and the Royal Navy. The family of aircraft consists of three variants: conventional takeoff and landing, air craft carrier (CV) suitable, short takeoff and vertical landing (STOVL). The Marines will use the STOVL variant, which will eventually replace both the AV-8B and the F/A-18C/D. Like all current Marine aviation assets, the JSF will provide visual, imagery, and electronic air reconnaissance capabilities inherent to MAGTF operations.

MICRO AIR VEHICLES (MAV)

Investigations are currently underway to define the role of a MAV in future service mission scenarios. MAV are conceptually to be self-contained miniature air vehicles that will have no dimension greater than 6 inches, with a total with no greater than 2.5 pounds. Sensors on board will be capable of providing imagery of targets, downlinked from a range of up to 5 NM. The MAV will have a cruising speed of approximately 50-mph and an endurance of 30 to 60 minutes. The MAV will be operated by front line troops.

TARGET LOCATION ERROR (TLE)

Equally important to sensor development is the creation of a joint dissemination infrastructure that supports the large data files associated with digital imagery. GPS guided munitions have already been demonstrated as being the precision guided munitions (PGM) of choice on the modern battlefield. This adds a serious burden to imagery requirements and the generation of highly precise target coordinates. These facts will require a revision in some operations and intelligence ambiguities in order to support a time control strike.

SUMMARY

Marine aviation has significantly improved its air reconnaissance capabilities in support of MAGTF and Joint operations since the early 1990's. This is a demonstration of the wide reach and influence that air reconnaissance has on many aspects of warfighting. The Marine Corps will continue to pursue the leading edge of technology and innovative tactics in order to continue to increase performance of existing systems and develop new systems to meet air reconnaissance requirements. The end-state of these emerging concepts and capabilities will increase the capabilities and responsiveness of commanders and decision makers in operations from war to MOOTW.

Appendix A

MAGTF Air Reconnaissance Aircraft and Mission Capabilities

Squadron Type	Aircraft Type	Type of Air Reconnaissance		
		Visual	Imagery	Electronic
Marine Attack Squadron (VMA)	AV-8B	*	*	*
Marine Fighter/Attack Squadron (VMFA)	F/A-18A/C	*	*	*
Marine All-Weather Fighter/Attack Squadron (VMFA(AW))	F/A-18D	X	X	*
Marine Tactical Electronic Warfare Squadron (VMAQ)	EA-6B	*		X
Marine Aerial Refueler Transport Squadron (VMGR)	KC-130	*		*
Marine Unmanned Aerial Vehicle Squadron (VMU)	UAV	*	X	
Marine Heavy Helicopter Squadron (HMH)	CH-53D/E	*		*
Marine Medium Helicopter Squadron (HMM)	CH-46E	*		*
Marine Light/Attack Helicopter Squadron (HMLA)	UH-1N,AH-1W	X	*	*
Marine Medium Tilt-Rotor Squadron (VMM)	MV-22	*		*

X Unit tasked specifically for that type of air reconnaissance mission.

* Unit is typically not tasked specifically for this type of air reconnaissance mission, however provides a capability to collect this type of intelligence information.

Appendix B

MAGTF Aircraft and Sensor Capabilities

Aircraft Type	Type of Air Reconnaissance	Sensor	Data Storage	Dissemination Method	Remarks
AV-8B	VISUAL	NVG (1)	8mm-3/4" TAPE (VOICE ONLY)	INFLIGHTREP/MISREP	(1) NIGHT ATTACK A/C ONLY
	IMAGERY: (OPTICAL)	ARBS (2) HAND-HELD CAMERA HUD CAMERA	8mm-3/4" TAPE DIGITAL/FILM 8mm-3/4" TAPE	INFLIGHTREP/MISREP HARD/SOFT COPY (3)	(2) DAY ATTACK A/C ONLY (3) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	IMAGERY: (NON-OPTICAL)	AGM 65F MAVERICK APG-65 RADAR (4) NAVFLIR (4) FLIR (5)	8mm-3/4" TAPE 8mm-3/4" TAPE 8mm-3/4" TAPE 8mm-3/4" TAPE	INFLIGHTREP/MISREP	(4) ONLY A/C WITH RADAR UPGRADE (5) A/C WITH LITENING II CAPABILITY
	ELECTRONIC	RWR	8mm-3/4" TAPE	INFLIGHTREP/MISREP	
AH-1W	VISUAL	NVG	VHS TAPE (VOICE ONLY)	INFLIGHTREP/MISREP	
	IMAGERY: (OPTICAL)	HAND-HELD CAMERA NTS (7) TSU	DIGITAL/FILM VHS TAPE VHS TAPE	HARD/SOFT COPY (6) INFLIGHTREP/MISREP	(6) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY (7) LOW LIGHT TV
	IMAGERY: (NON-OPTICAL)	NTS (8)	VHS TAPE	INFLIGHTREP/MISREP	(8) INFRARED
	ELECTRONIC	RWR		INFLIGHTREP/MISREP	
C-130	ELECTRONIC	RWR	NO CAPABILITY	INFLIGHTREP/MISREP	
CH-46	VISUAL	NVG	NO CAPABILITY	INFLIGHTREP/MISREP	
	IMAGERY: (OPTICAL)	HAND-HELD CAMERA	DIGITAL/FILM	HARD/SOFT COPY (9) INFLIGHTREP/MISREP	(9) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	ELECTRONIC	RWR	NO CAPABILITY	INFLIGHTREP/MISREP	

Aircraft Type	Type of Air Reconnaissance	Sensor	Data Storage	Dissemination Method	Remarks
CH-53D/E	VISUAL	NVG	NO CAPABILITY	INFLIGHTREP/MISREP	
	IMAGERY: (OPTICAL)	HAND-HELD CAMERA	DIGITAL/FILM	HARD/SOFT COPY (10)	(10) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	IMAGERY: (NON-OPTICAL)	FLIR (11)	NO CAPABILITY	INFLIGHTREP/MISREP	(11) ONLY ON MODIFIED A/C
	ELECTRONIC	RWR	NO CAPABILITY	INFLIGHTREP/MISREP	
EA-6B	ELECTRONIC	ONBOARD SENSORS	RRS TAPE (NO VOICE)	INFLIGHTREP/MISREP	NATIONAL ASSET
FA-18 A/C/D	VISUAL	NVG (12)	8mm-3/4" TAPE (VOICE ONLY)	INFLIGHTREP/MISREP	(12) FA-18A'S ARE RECEIVING NVG UPGRADE
	IMAGERY: (OPTICAL)	ATARS-LAEO (13) ATARS-MAEO (13) HAND-HELD CAMERA HUD CAMERA LTD/STRIKE CAMERA	DIGITAL TAPE DIGITAL TAPE DIGITAL/FILM 8mm-3/4" TAPE FILM	HARD/SOFT COPY (14) HARD/SOFT COPY (14) HARD/SOFT COPY (14) INFLIGHTREP/MISREP HARD COPY	(13) ONLY F/A-18D DESIGNATED SQUADRONS (14) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	IMAGERY: (NON-OPTICAL)	AGM-65F MAVERICK AGM-84E SLAM (15) APG-65 RADAR APG-73 RADAR (16) ATARS-IRLS (16) ATARS-SAR (16) FLIR NAVFLIR	8mm-3/4" TAPE 8mm-3/4" TAPE 8mm-3/4" TAPE 8mm-3/4" TAPE DIGITAL TAPE DIGITAL TAPE 8mm-3/4" TAPE 8mm-3/4" TAPE	INFLIGHTREP/MISREP HARD/SOFT COPY (17) HARD/SOFT COPY (17)	(15) ONLY LOT 11 A/C & ABOVE (16) ONLY DESIGNATED SQUADRONS (17) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	ELECTRONIC	AGM-88 HARM RWR	8mm-3/4" TAPE 8mm-3/4" TAPE	INFLIGHTREP/MISREP	
MV-22	VISUAL	NVG	8mm-3/4" TAPE (VOICE)	INFLIGHTREP/MISREP	
	ELECTRONIC	RWR	8mm-3/4" TAPE	INFLIGHTREP/MISREP	

Aircraft Type	Type of Air Reconnaissance	Sensor	Data Storage	Dissemination Method	Remarks
UAV	IMAGERY: (OPTICAL)	MKD-200 TV CAMERA	½-3/4" TAPE	INFLIGHTREP/MISREP	
	IMAGERY: (NON-OPTICAL)	MDK-400 FLIR	½-3/4" TAPE	INFLIGHTREP/MISREP	
UH-1N	VISUAL	NVG	NO CAPABILITY	INFLIGHTREP/MISREP	
	IMAGERY: (OPTICAL)	HAND-HELD CAMERA	DIGITAL/FILM	HARD/SOFT COPY (18) INFLIGHTREP/MISREP	(18) SIPRNET CONNECTIVITY REQUIRED FOR SOFT COPY
	IMAGERY: (NON-OPTICAL)	NTIS (FLIR)	VHS TAPE	INFLIGHTREP/MISREP	
	ELECTRONIC	RWR	NO CAPABILITY	INFLIGHTREP/MISREP	

Appendix C

Non Organic MAGTF Air Reconnaissance Aircraft and Functions

Theater Assets	Aircraft Type	Air Reconnaissance Functions		
		Visual	Imagery	Electronic
Manned				
U.S. NAVY	E-2C			X
U.S. AIR FORCE	E-8C		X	X
U.S. AIR FORCE	EA-3			X
U.S. AIR FORCE	EC-130			X
U.S. NAVY	EA-6B			X
U.S. NAVY	EP-3E		X	X
U.S. NAVY	ES-3A		X	X
U.S. NAVY	F-14		X	
U.S. NAVY	F/A-18E/F		X	
U.S. AIR FORCE	F-16C		X	
U.S. AIR FORCE	RC-135			X
U.S. AIR FORCE	U-2		X	X
U.S. ARMY	RC-12			X
U.S. ARMY	RC-7		X	X
Unmanned				
U.S. AIR FORCE	Predator		X	
U.S. AIR FORCE	Global Hawk		X	
ARMY	Shadow		X	
Space Systems				
CIA, DIA, NSA, CIO, NRO	Satellites		X	X

Air Reconnaissance Platforms and Functions

There are a number of imagery and electronic air reconnaissance collection systems which may be employed to provide support to a MAGTF which may be operating in a fleet or joint environment. Selected imagery and electronic reconnaissance collection systems are discussed below. However, the details of certain system capabilities and sensor performance characteristics are classified.

MANNED AIR RECONNAISSANCE PLATFORMS

In support of MAGTF operations, manned air reconnaissance assets of other Services within the theater may by supporting Marines. The capability exists from data produced by these platforms to be transmitted over secondary imagery dissemination system (SIDS) networks.

The **E-8C Joint Surveillance Target Attack Radar System (*"JSTARS"*)** is designed to meet the operational need to detect, locate, classify and track both fixed and mobile

ground targets, slow-moving rotary-wing and fixed-wing aircraft, and rotating antennas in all-weather conditions. The systems synthetic aperture radar is designed to support precision engagement of time-sensitive targets and provide a synoptic battlefield view in near real time. Future plans for *"JSTARS"* include growth potential for enhanced SAR, inverse SAR, and automatic target recognition. JSTARS currently downlinks collected radar data to a unique ground station module (GSM), which provides tactical data processing and evaluation. An upgraded ground station, the common ground station (CGS) is designed to support the platform by providing a greater capability to distribute targeting information through SIDS.

The **E-3 Airborne Warning and Control System (***"AWACS"***)** is an airborne early warning (AEW), command and control aircraft. It is designed to provide highly mobile, flexible and survivable wide area surveillance and control capability and to overcome the inherent limitations of ground based radar systems. *"AWACS"* is a system that provides the air component commander (ACC) with tactical battle management in an operating area. There is no ground/surface system to receive, process, exploit, or communicate intelligence information. All *"AWACS"* mission functions involving surveillance and reconnaissance are performed on the aircraft.

The **EC-130 *"Senior Scout"*** system is a palletized collection capsule (or "modular" SIGINT package) designed for insertion and removal in any C-130E/H aircraft. It provides rapidly deployable worldwide SIGINT support for theater, national, and special operations requirements. It also provides timely, tailored intelligence reporting to meet user needs. Primary operation is in the standoff mode and is self-contained for autonomous operation.

The US Navy's **EA-6B *"Prowlers"*** provide the same electronic reconnaissance capabilities as the Marine's *"Prowlers*." See chapters one and two for more information on *"Prowlers*."

The **EP-3E *"Aries II"*** provides over-the-horizon SIGINT collection for Navy Fleet and Joint commanders. It provides near-real-time intelligence and targeting missions in support of naval/joint task forces. The EP-3E is a standoff platform and supports tactical commanders in exploiting threat communications (COMINT) and non-communications (ELINT) emitters.

The **F-14 *"Tomcat's"*** Tactical Airborne Reconnaissance Pod System (TARPS) configured system actively supports various national and theater intelligence objectives. It is the primary source of tactical photographic imagery for U.S. armed forces. With a variety of camera systems, the system can be used for forward oblique (KS-87) and mid to high altitude tasking. The KS-153 is used for standoff photography and the KA-99 is used for low-altitude panoramic missions. Originally designed as a short-term interim system, it has received both sensor and pod upgrades to maintain its effectiveness until phase-in replacement by the F/A-18E/F SHARP system. Forty-seven pods remain in service today and provide a day, high-speed overflight, medium-range standoff, and high-resolution capability.

The Tactical Airborne Reconnaissance Pod System – Digital Imagery (TARPS-DI) is an upgrade to the basic film version of TARPS to provide a near-real-time imaging capability. The original TARPS pod configuration was modified by replacing the forward framing camera with a small format, short focal length, digital, EO type sensor. The sensor is fixed in the vertical position and imagery is simultaneously displayed and recorded onboard or transmitted by means of a narrow band, encrypted, UHF radio link. Although TARPS-DI provides timely access to imagery, it also requires an overflight of the target and approximately 2 minutes to transmit one frame of imagery. Both TARPS systems include an IR line scanner to give it a night air reconnaissance capability.

The **F/A-18E/F** *"Super Hornet"* has incorporated the shared reconnaissance pod (SHARP) to meet the Navy's requirement for an organic, day/night, manned tactical air reconnaissance capability to provide intelligence support to the Battle Group Commander. The system will replace the F-14 TARPS scheduled to begin phase out in FY03. SHARP will be installed initially on the F/A-18E/F on the centerline station and employ a suite of sensors to collect infrared and visible digital imagery at medium and high altitudes, from overflight to long standoff distances. SHARP is scheduled to deploy with the first F/A-18E/F squadron in FY03.

The **F-16C** *"Falcons"* have a limited amount of aircraft that possess the capability to carry the tactical air reconnaissance system (TARS). The TARS is a pod system to provide "under the weather" reconnaissance capability to support intelligence and targeting requirements. The TARS provides a single forward-looking EO framing sensor, sensor control, second sensor window, data recording, and internal pod environmental control. The pod will be carried on the centerline station of F-16C aircraft operated by the Richmond, Virginia, Air National Guard.

The **U-2** provides continuous day or night, high altitude, all weather, standoff surveillance in support of the tactical commander. Imagery collected by the U-2 can be downlinked directly to the TEG. The aircraft's multi-sensor capability includes photographic, EO, infrared, and SAR.

The **RC-7 Airborne Reconnaissance Low (*"ARL"*)** is a versatile multi-function, day/night, all-weather airborne reconnaissance system. This U.S. Army system provides tactical commanders with real-time and near-real time airborne SIGINT and IMINT collection and designated area surveillance. The IMINT payload consists of EO, IR and SAR-type sensors, recorders and data link. Intelligence collected on ARL's can be analyzed and recorded on the workstations or stored on board for post mission processing.

The **RC-12** *"GUARDRAIL"* provides airborne COMINT/SIGINT collection and locations systems with ground-based processing, analysis and reporting capabilities. The RC-12 GRCS is a standoff platform requiring two to three aircraft for precise geolocation using on-board direction-finding equipment. There are several generations of the system currently in service with the U.S. Army, and each with different capabilities. The

GUARDRAIL system is carried on the C-12 "Super King" aircraft. A GUARDRAIL system consists of an integrated processing facility (IPF), 6-12 airborne relay facilities (ARF), and auxiliary ground equipment test van (AGE), three interoperable data links (IDL), a power generation system and associated ground support equipment.

RC-135 *"Rivet Joint"*, **ES-3A** *"Shadow"*, and **E-2C** *"Hawkeye"*, are other aircraft capable of collecting electronic air reconnaissance information and providing surveillance in support of MAGTF planning and operations.

UNMANNED AIR RECONNAISSANCE PLATFORMS

UAV's provide significant advantages over the other reconnaissance assets. The greatest advantage of these systems is that they normally do not put friendly personnel at risk, can have relatively long loiter times, and they are generally less expensive than today's manned high value air reconnaissance assets. UAV capabilities vary according to system and operational requirements. Once the technology has matured, UAV's will be configured with a broad range of collection capabilities to include a wide variety of electronic and imagery collection capabilities. Current UAV's are primarily tactical in nature, characterized by specific mission capabilities, and relatively small area coverage. Future systems will provide broad area coverage with more capable sensors. The range and endurance of UAV's will vary based on the particular UAV employed. Payload constraints often permit less than the full complement of sensors desired for a given tasking. Finally, commanders should understand UAV capabilities to support mission requirements as well as their limitations.

RQ-1A *"Predator"* is a medium altitude tactical reconnaissance UAV. Its payload consists of staring (rapid framing) array EO and IR sensors, as well as synthetic aperture radar. A data link provides both wide-band LOS and satellite communications (SATCOM) over-the-horizon capability. However, due to current communication architecture, the TEG is not capable of receiving direct downlink from *"Predator."* Predator information can only be transmitted to TEG through SIDS. The UAV is capable of full autonomous operation while flying for 40 hours (including continuous 24-hour on-station coverage at 500 NM). The complete system, including ground control station, is air transportable and operational six hours after arrival on-site.

RQ-4 *"Global Hawk"* is a high altitude, endurance UAV designed for surveillance of very large surface areas. The platform's payload consists of a combination of EO/IR standoff sensors for both day and night missions and a SAR sensor for all weather operations. A wide-band width data link provides direct downlink to compatible receiving stations. The TEG will receive direct downlink from the *"Global Hawk"*. The *"Global Hawk"* has a flight range of 3000 NM with an on-station time endurance of 24 hours.

"Shadow" **Tactical UAV** was recently selected by the Army to provide brigade commanders with close range reconnaissance and target acquisition capability. The *"Shadow"* payload includes an advanced EO/IR payload configured with small format

sensor installed in a tracking turret and a TCDL that will permit a range of at least 27nm and has an on-station time of three hours.

SPACE SYSTEMS

Satellites have become an integral part of military forces providing support across the range of military operations. Space systems help provide weather, imagery (to include multi-spectral imagery), and electronic reconnaissance information to commanders. Commanders must also be aware of the advantages and limitations of these systems. Because satellites can be placed into orbits that maximize their effectiveness, the prime advantage of these systems is their ability to provide worldwide coverage of areas of interest, especially those remote or hostile areas where little or no data can be obtained from conventional sources. Other advantages these systems possess include mission longevity and relative immunity from adversary action. Their limitations include the same atmospheric and weather disturbances that affect most imagery systems. In addition, space systems' schedules are predictable; they are therefore vulnerable to denial and deception practices and signature control activities such as emission control, camouflage, etc. Satellite systems can also provide geographic and detailed terrain information that enhances mission planning capabilities. Satellite communications and navigation systems can aid operations by distributing the products generated from air reconnaissance systems and by providing weapons and sensor systems with accurate positioning information.

Appendix D

Joint Tactical Air Reconnaissance/Surveillance Request (JTAR/S)

PRECEDENCE

FROM:

TO:

INFO:

CLASSIFICATION

SUBJ: JTARS REQ

L. REQUEST NO._____   PREPLANNED A. PRIORITY B: PRECEDENCE_____
                           IMMEDIATE   C. PRIORITY

M. DATE-TIME FACTORS

1. DATE MISSION DESIRED
2. TOT (IF REQ)
3. LTIOV
4. PRIOR COVERAGE ACCEPTABLE (DAYS PRIOR)

N. TYPE RECON REQUESTED

1. TYPE MISSION:

    A. VISUAL
    B. IMAGERY
    C. ELECTRONIC

2. TYPE COVERAGE:

    A. PINPOINT
    B. STRIP/LINE OF COMMUNICATION
    C. ROUTE RECONNAISSANCE
    D. AREA SEARCH
    E. AREA COVERAGE
    F. AFLOAT

3. SENSOR TYPE:

      A. OPTICAL
      B. IR
      C. SLAR
      D. ELECTRONIC
      E. LASER
      F. OTHER

4. TYPE PHOTO:

      A. VERTICAL
      B. OBLIQUE
      C. PANORAMIC

5. TYPE FILM:

      A. BLACK AND WHITE
      B. COLOR
      C. CAMOUFLAGUE DETECTING

6. STEREO PHOTO:

      A. NOT REQUIRED
      B. REQUIRED

O. MAP REFERENCE:

      TYPE AND SCALE_____
      SERIES_____
      SHEET_____
      EDITION_____
      DATE_____

P. TARGET COORDINATES:

      A. UTM
      B. LAT/LONG
      C. OTHER (SPECIFY)

Q. TARGET CATEGORY/PRIORITY INTELLIGENCE REQUIREMENT(S) (SEE DETAILED INSTRUCTION)

1. AIRFIELD
2. ARMOR/ARTY/TROOPS/VEH
3. BRIDGE
4. DEF POS/STRONG PT/GUN

5. ELECTRONIC SITE
6. HARBOR SITE
7. INDUSTRIAL
8. LOC
9. MIL. INST/STORAGE AREA
10. MISSILE SITE
11. POWER PRODUCTION FACILITY
12. RAILROAD YARD
13. SHIPS
14. OTHER (SPECIFY)

R. REPORTS:

1. IN-FLIGHT REPORT   (CS/FREQ)_____VALID FM_____Z TO_____Z
                                          (CS/FREQ)_____VALID FM_____Z TO_____Z
2. MISSION REPORT
3. RECEXREP
4. IPIR
5. SUPIR

S. IMAGERY PRODUCTS (IF REQUIRED)

1. TYPE
2. QUANTITY
3. ADDITIONAL INFORMATION

T. DELIVERY ADDRESS:

1. UNIT_____
2. AIR DROP (IF REQ): COORDS:_____
   CALL SIGN/FREQ_____
   RUN HEADING (MAG) (OPTIONAL)_____

U. REMARKS/SPECIAL INSTRUCTIONS:

1. TARGET AREA CONTROL (CALL SIGN/FREQ)_____
2. OTHER (SPECIFY)_____

NOTES:
1. Designate minimum mandatory items for immediate requests.
2. Indicates use as applicable or when known.
3. The format provided has been published as STANAG 3277 and has been approved by NATO as a standard format for aerial requests. The letters A to K have special significance for certain organizations and are purposely omitted.
4. When submitting message JTARS, the paragraph headings are not required, but the alpha-numeric paragraphs will not be changed.
5. Instructions for completing a JTARS are as follows:

PARAGRAPH LETTERS INSTRUCTIONS

L. Request number: As directed.
    A&C Priority: Use numerical designation below to define the tactical urgency for
                             preplanned and immediate requests.
    PRIORITY: It is the responsibility of the requestor to establish the priority.

    Priority No.   Definition

        1   Takes precedence over all other requests except previously assigned Priority 1
                      requests. The results of these requests are of paramount importance to the
                      immediate battle situation or objective.

        2   The results of these requirements are in support of the general battle situation and
                      will be accomplished as soon as possible after Priority 1 requests. These are
                      requested to gain current battle information.

        3   The results of these requests update the intelligence data base but do not effect
                      the immediate battle situation.

        4   The results of these requests are of a routine nature and will be fulfilled when the
                      reconnaissance effort permits.

M. DATE/TIME FACTORS

    1. Self-explanatory.

    2. a. State the Time on Target only when required.
        b. Justify U2.

    3. Latest Time Information of Value (LTIOV). Indicate, if it is a factor, the LTIOV. Deliver prior
        to this date/time.

    4. Self-explanatory.

N. TYPE RECONNAISSANCE REQUESTED

    1. Type Mission -- Self-explanatory.
    2. Type Coverage
        a. Pinpoint -- Self-explanatory.
        b. Strip/Lines of Communication -- Search Continuous photography of a route of LOC.
        c. Route Reconnaissance -- Visual reconnaissance of a route of LOC with photo of targets of
            military significance.
        d. Area Search -- Visual search of a specified area with photos of targets of military
            significance.
        e. Area Coverage -- Photographic coverage of a specified area.

      f.   Afloat -- Reconnaissance of vessels afloat.

3, 4, and 5. Self-explanatory. These lines should be left blank unless it is fully understood what the selected sensor, photo, and film can accomplish.

O. MAP REFERENCE. Self-explanatory.

P. TARGET COORDINATES. Provide reference system used and indicate actual coordinates.

Q. TARGET CATEGORY/PRIORITY INTELLIGENCE REQUIREMENT(S). Provide the appropriate category and indicate the desired PIR by selecting the number(s) from the target list category below.

CATEGORY 1 -- AIRFIELD

A. Activity: Number, type, and location of aircraft.
B. Runways: Number, orientation, and surface type.
C. Taxiway and parking areas: Loacation and shape.
D. POL: Number, size, and location.
E. Ammunition storage areas: Number and location.
F. Hangars: Number, size, and type construction.
G. Electronic facilities: Number, type, and location.
H. Defenses: Number, type, and location.
I. Other: (specify).

CATEGORY 2 -- ARMOR/ARTY/TROOPS/VEHICLES

A. Type: Infantry, armor, engineering, artillery, etc.
B. Number and type of vehicles.
C. Number and type of armor.
D. Number and type of artillery.
E. Activity: Direction of movement, dug in, etc.
F. Terrain: Description.
G. Other: (specify).

CATEGORY 3 -- BRIDGE

A. Purpose: Flood, rail, over road, etc.
B. Type: Railroad, vehicular, agricultural, etc.
C. Construction: Wood, steel, concrete, etc.
D. Construction: Piers, abutments, approaches, stringers, beam, truss, etc.
E. Number of spans.
F. Length and width (height if significant)
G. Number of lanes/tracks.
H. Bypass in vicinity of bridge.
I. Activity.
J. Other: (specify).

CATEGORY 4 -- DEFENSIVE POSITIONS/STRONG POINTS/GUNS

A. Type and size of position or fortification.
B. Type weapons: Number.
C. Fire control system.
D. Supporting positions.
E. Transportation access.
F. Routes of ingres and egress.
G. Nature of surrounding terrain and foliage barriers
H. Activity.
I. Other (specify).

CATEGORY 5 -- ELECTRONIC SITE

A. Type site: Microwave relay, EW, etc.
B. Antennas: Number and type.
C. Mobile or permanent.
D. Primary buildings and support equipment.
E. Activity.
F. Security measures.
G. Size of area.
H. Other (specify).

CATEGORY 6 -- HARBOR/PORT FACILITIES

A. Type port: Maritime or inland waterway.
B. Activity.
C. Berthing and cargo handling facilities.
D. POL facilities: Type, number, and locations.
E. Storage facilites.
F. Shipbuilding and repair facilities.
G. Transportation.
H. Defenses.
I. Other (specify).

CATEGORY 7 -- INDUSTRIAL SITE

A. Type of industry.
B. Size of area.
C. Buildings: Number, size, and construction.
D. Open storage: Quantity by type.
E. Activity.
F. Transportation facilities.
G. Source of power.
H. Defenses.
I. Other (specify).

CATEGORY 8 -- LINES OF COMMUNICATIONS (LOC)

A. Type: Road, rail, canal, etc.
B. Description of the route.
C. Chokepoints.
D. Significant activity.
E. Significant static targets.
F. Other (specify).

CATEGORY 9 -- MILITARY INSTALLATIONS/STORAGE AREAS

A. Function: Assembly, admin, barracks, depot, etc.
B. Activity: Number of vehicles and/or personnel.
C. Size of the area.
D. Number of buildings: Predominant construction only.
E. Storage: type and location.
F. Transportation.
G. Defenses.
H. Other (specify).

CATEGORY 10 -- MISSILE SITE

A. Type.
B. Launch site: Mobile/fixed, number of pads, etc.
C. Number and orientation of launchers/number loaded.
D. Control center: Location and construction.
E. Number, type and location antenna(s).
F. Auxiliary equipment.
G. Activity.
H. Defenses.
I. Other (specify).

CATEGORY 11 -- POWER PRODUCTION FACILITY

A. Type: Nuclear, coal, oil, hydroelectric, etc.
B. Size and construction.
C. Boiler/generators: Number and location.
D. Transformer yard: Size and location.
E. Cooling towers: Number and location.
F. Penstock/turbine outlet (hydroelectric).
G. Activity.
H. Defenses.
I. Other.

CATEGORY 12 -- RAILROAD YARD

   A. Type: Classification, repair, other.
   B. Length and width: Chokepoint to chokepoint.
   C. Number of tracks.
   D. Facilities: Repair shops, roundhouses, other.
   E. Rolling stock.
   F. Defenses.
   G. Other (specify).

CATEGORY 13 -- SHIPS

   A. Class/type/number.
   B. Heading/movement.
   C. Nationality.
   D. Identification.
   E. Cargo.
   F. Activity.
   G. Other.

CATEGORY 14 -- OTHER

Narrative report is rendered under this heading in sufficient detail to ensure that the request or purpose of the mission is satisfied.

R. REPORTS

   1. IN-FLIGHT -- An inflight report to friendly units.
   2. MISSION REPORT -- A mission report of the results and significant sightings gathered.
   3. RECONNAISSANCE EXPLOITATION REPORT -- A brief, concise, high priority report on time-sensitive targets of significant tactical importance of a perishable nature.
   4. INITIAL PHOTOGRAPHIC INTERPRETATION REPORT -- -An initial photo interpretation report which contains intelligence on mission objectives and additional significant intelligence.
   5. SUPPLEMENTAL PHOTOGRAPHIC INTERPRETATION REPORT -- A supplemental photo interpretation report which provides detailed intelligence acquired through a comprehensive study of imagery.

S. IMAGERY PRODUCTS -- Specify type and quantity of imagery products required. Only mission essential imagery products should be requested.

T. DELIVERY ADDRESS

   1. Unit -- Delivery address for mission essential imagery products.
   2. Air Drop -- Coordinates, call sign, frequency, and run in heading for aerial delivery of imagery products.

U. REMARKS/SPECIAL INSTRUCTIONS

   1. Target Area Control -- Indicate, when applicable, the callsign and radio frequency of the control element. Control of the mission will require close coordination with ground forces.
   2. Other -- Self-explanatory (use this space to specify scale if required and to request specific TOT).

Appendix E

In-flight Report (INFLIGHTREP) Format

USMC INFLTREP	Remarks
Aircrew transmit: _____, this is _____, in-flight report, over addressee call sign.	
Expect or conduct authentication if on uncovered net.	
This _____, in-flight report	
(1) Call sign _____	
(2) Mission number _____	
(3) Request number (if applies) _____	
(4) Target location _____	
(5) Time on target _____	
(6) Results (BDA) _____	

(7) Remarks _____
     _____
     _____
	i.e., area weather and enemy situation after attack.

Appendix F

Mission Report (MISREP) Format

PRECEDENCE

FROM:

TO:

INFO:

CLASSIFICATION

SUBJ: MISREP NO. _____/_____Z/MONTH/YEAR

REF: (a) As appropriate.

BODY

1. Air Task/Mission Number or Nickname. Reference the request number, FRAGO number, or directive causing initiation of the mission.

2. Location Identifier. Target number, line number, approved target designator/identifier, or coordinates of the target or sighting being reported.

3. Time of Target/Time of Sighting. Report at all times by date/time group, using GMT unless otherwise directed.

4. Results/Sighting Information. This item should contain the pilot/aircrew evaluation of expected results (e.g., percent destroyed, number and type destroyed, or percent of coverage) and concise narrative information on significant sightings (e.g., unusual or new enemy equipment or concentrations of enemy forces observed to include number, speed, and direction, if applicable).

5. Remarks. Includes information and intelligence not specifically mentioned in above items (e.g., enemy defenses encountered; weather data; hostile electronic attacks; etc.).

Appendix G

Glossary

Section I. Acronyms and Abbreviations

AAA	anti aircraft artillery
AAW	antiair warfare
ACA	airspace coordination area
ACE	aviation combat element
ACO	airspace control order
ACP	airspace control plan
AH-1W	attack helicopter (Cobra)
AOC	air operations center
ARBS	angle rate bombing system
ARG	amphibious ready group
ASC(A)	assault support coordinator (airborne)
ASE	assault support element
ATARS	advanced tactical airborne reconnaissance system
ATC	air traffic control
ATO	air tasking order
AV-8B	attack aircraft (Harrier)
BDA	battle damage assessment
	bomb damage assessment
C2	command and control
C3	command, control, and communication
C-130	cargo aircraft (Hercules)
CCD	camouflage, concealment, and deception
CCIR	commander's critical information requirement
CG	commanding general
CH-46	medium assault support helicopter (Sea Knight)
CH-53D/E	medium/heavy assault support helicopter (Sea/Super Stallion)
CIS	communications and information system
COA	course of action
COG	center of gravity
CSSE	combat service support element
CTAPS	contingency theater automated planning system
DAS	deep air support
DASC	direct air support center
DASC(A)	direct air support center (airborne)
DOD	Department of Defense

EA-6B	all weather electronic attack aircraft (Prowler)
ELINT	electronic intelligence
EMCON	emissions control
EO	electro-optical
EOB	electronic order of battle
EOTDA	electro-optical target decision aid
ES	electronic support
ESM	electronic support measures
EW	electronic warfare
EW/C	early warning/control
F/A-18	fighter attack aircraft (Hornet)
FAC(A)	forward air controller (airborne)
FARP	forward arming and refueling point
FLIR	forward looking infrared
FSCC	fire support coordination center
FSCL	fire support coordination line
G2	intelligence officer (major subordinate command)
G3	operations officer (major subordinate command)
G6	communications and information systems officer (major subordinate command)
GCE	ground combat element
GCS	ground control station
GDT	ground data terminal
GPS	global positioning system
HARM	high-speed anti-radiation missile
HMH	Marine heavy helicopter squadron
HMLA	Marine light attack helicopter squadron
HMM	Marine medium helicopter squadron
HMMWV	high mobility multi-purpose wheeled vehicle
HPT	high-payoff target
HVT	high-value target
HUD	head-up display
IAS	intelligence analysis system
IFF	identification friend or foe
IMINT	imagery intelligence
INFLTREP	inflight report
INS	inertial navigation system
IOC	intelligence operations center
IR	infrared
	information requirement
IRLS	infrared line scanner

JAC	joint analysis center
JAOC	joint air operation center
JFACC	joint force air component commander
JFC	joint force commander
JIC	joint intelligence center
JTAR/SR	joint tactical air reconnaissance/surveillance request
JTF	joint task force
LAAD	low altitude air defense
LAEO	low altitude electro-optical
LDT	laser detector
LOC	lines of communication
LNO	liaison officer
MACCS	Marine air command and control system
MACG	Marine air control group
MAEO	medium altitude electro-optical
MAG	Marine aircraft group
MAGTF	Marine air-ground task force
MASS	Marine air support squadron
MATCD	Marine air traffic control detachment
MAW	Marine aircraft wing
MCISU	Marine Corps imagery processing unit
MCPP	Marine Corps planning process
MEF	Marine expeditionary force
MEU	Marine expeditionary unit
MISREP	mission report
MPCS	mission planning and control station
MPS	mission planning station
MRR	minimum risk route
MSC	major subordinate command
NAI	named area of interest
NAO	naval aerial observer
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, chemical
NRT	near-real-time
NITF	national imagery transmission format
NTIS	night thermal imaging system
NTS	night targeting system
NVG	night vision goggle
NVD	night vision device
OAS	offensive air support
OMFTS	operational maneuver from the sea

OPCON	operational control
OPT	operational planning team
PIREP	pilots report
ROA	restricted operating area
ROE	rules of engagement
ROZ	restricted operating zone
RT	real-time
RTF	return to force
RVT	remote video terminal
S2	intelligence officer (units and organizations below the major subordinate command level)
S3	operations officer (units and organizations below the major subordinate command level)
S6	communications and information systems officer (units and organizations below the major subordinate command level)
SA	situational awareness
SAM	surface to air missile
SAR	synthetic aperture radar
SARC	surveillance and reconnaissance cell
SEAD	suppression of enemy air defenses
SGS	squadron ground station
SIDS	secondary imagery dissemination system
SIGINT	signals intelligence
SIPRNET	secret internet protocol router network
SPINS	special instructions
SVHS	standard very high speed
TAC(A)	tactical air coordinator (airborne)
TACC	tactical air command center
TACP	tactical air control party
TAD	tactical air direction
TADC	tactical air direction center
TAI	target area of interest
TAMPS	tactical aviation mission planning system
TAOC	tactical air operations center
TBMCS	theater battle management core system
TDN	tactical data network
TEAMS	tactical EA-6B mission planning system
TEG	tactical exploitation group
TERPES	tactical electronic reconnaissance processing evaluation system
TIGDL	tactical interoperable ground data link

TSU	telescopic sight unit
UAV	unmanned aerial vehicle
UH-1N	utility helicopter (Huey)
US	United States
VHS	very high speed
VMA	Marine attack squadron
VMAQ	Marine tactical electronic warfare squadron
VMFA	Marine fighter/attack squadron
VMFA(AW)	Marine fighter/attack (all weather) squadron
VMU	Marine unmanned aerial vehicle squadron
VTR	video tape recording

Section II. Definitions

airborne early warning – the detection of enemy air or surface units by radar or other equipment carried in an airborne vehicle, and the transmitting of a warning to friendly units. Also called **AEW**. (Joint Pub 1-02)

air reconnaissance – The acquisition of intelligence information by employing visual observation and/or sensors in air vehicles. (Joint Pub 1-02)

airspace control order – An order implementing the airspace control plan that provides the details of the approved requests for airspace control measures. It is published either as part of the air tasking order or as a separate document. Also called **ACO**. (Joint Pub 1-02)

airspace control plan – The document approved by the joint force commander that provides specific planning guidance and procedures for the airspace control system for the joint force area of responsibility/joint operations area. Also call **ACP**. (Joint Pub 1-02)

airspace coordination area – A three-dimensional block of airspace in a target area, established by the appropriate ground commander, in which friendly aircraft are reasonably safe from friendly surface fires. The airspace coordination area may be formal or informal. Also called **ACA**. (Joint Pub 1-02)

air support request – A means to request preplanned and immediate close air support, air interdiction, air reconnaissance, surveillance, escort, helicopter airlift, and other aircraft missions. Also called **AIRSUPREQ**. (Joint Pub 1-02)

air surveillance – The systematic observation of airspace by electronic, visual or other means, primarily for the purpose of identifying and determining the movements of aircraft and missiles, friendly and enemy, in the airspace under observation. (Joint Pub 1-02)

air tasking order – A method used to task and disseminate to components, subordinate units, and command and control agencies projected sorties/capabilities/forces to targets and specific missions. Normally provides specific instructions to include call signs, targets, controlling agencies, etc., as well as general instructions. Also called **ATO**. (Joint Pub 1-02)

allocation (air) – The translation of the air apportionment decision into total numbers of sorties by aircraft type available for each operation or task. (Joint Pub 1-02)

antiair warfare – A US Navy/US Marine Corps term used to indicate that action required to destroy or reduce to an acceptable level the enemy air and missile threat. It includes such measures as the use of interceptors, bombers, antiaircraft guns, surface-to-air and air-to-air missiles, electronic attack, and destruction of the air or missile threat both before and after it is launched. Other measure which are taken to minimize the effects of hostile air action are cover, concealment, dispersion, deception (including electronic), and mobility. Also called **AAW**. (Joint Pub 1-02)

apportionment (air) – The determination and assignment of the total expected air effort by percentage and/or by priority that should be devoted to the various air operations and/or geographic areas for a given period of time. Also called **air apportionment**. (Joint Pub 1-02)

area of interest – That area of concern to the commander, including the area of influence, areas adjacent thereto, and extending into enemy territory to the objectives of current or planned operations. This area also includes areas occupied by enemy forces who could jeopardize the accomplishment of the mission. (Joint Pub 1-02)

area of operation – An operational area defined by the joint force commander for land and naval forces. Areas of operation do not typically encompass the entire operational area of the joint force commander, but should be large enough for component commanders to accomplish their missions and protect their forces. Also call AO. (Joint Pub 1-02)

aviation combat element – See **Marine air-ground task force**.

battle damage assessment – The timely and accurate estimate of damage resulting from the application of military force, either lethal or non-lethal, against a predetermined objective. Battle damage assessment can be applied to the employment of all types of weapon systems (air, ground, naval, and special forces weapon systems) throughout the range of military operations. Battle damage assessment is primarily an intelligence responsibility with required inputs and coordination from the operators. Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment. Also called **BDA**. (Joint Pub 1-02)

battlespace – All aspects of air, surface, subsurface, land, space, and electromagnetic spectrum which encompasses the area of influence and area of interest. (MCRP 5-12C)

centers of gravity – Those characteristics, capabilities, or localities from which a military force derives its freedom of action, physical strength, or will to fight. Also called **COG**. (Joint Pub 1-02)

centralized control – In air defense, the control mode whereby a higher echelon makes the direct target assignments to fire units. (Joint Pub 1-02)

collection – The obtaining of information in any manner, including direct observation, liaison with official agencies, or solicitation from official, unofficial, or public sources. (Joint Pub 1-02)

combat information – Unevaluated data, gathered by or provided directly to the tactical commander which, due to its highly perishable nature or the criticality of the situation, cannot be processed into tactical intelligence in time to satisfy the user's tactical intelligence requirements. (Joint Pub 1-02)

combat service support element – See **Marine air-ground task force**.

command and control – The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called **C2**. (Joint Pub 1-02)

command element – See **Marine air-ground task force**.

commander's critical information requirements – Information regarding the enemy and friendly activities and the environment identified by the commander as critical to maintaining situational awareness, planning future activities, and facilitating timely decision making. Also called **CCIR**. Note: CCIR's are normally divided into three primary subcategories: priority intelligence requirements, friendly force information requirements, and essential elements of friendly information. (MCRP 5-12C)

commander's intent – A commander's clear, concise articulation of the purpose(s) behind one or more tasks assigned to a subordinate. It is one of two parts of every mission statement which guides the exercise of initiative in the absence of instructions. (MCRP 5-12C)

critical vulnerability – An aspect of a center of gravity that if exploited will do the most significant damage to an adversary's ability to resist. A vulnerability cannot be critical unless it undermines a key strength. Also called **CV**. (MCRP 5-12C)

decentralized control – In air defense the normal mode whereby a higher echelon assignments to units only when necessary to ensure proper fire distribution or to prevent engagement of friendly aircraft. (Joint Pub 1-02)

direct air support center – The principal air control agency of the US Marine air command and control system responsible for the direction and control of air operations directly supporting the ground combat element. It processes and coordinates requests for immediate air support and coordinates air missions requiring integration with ground forces and other supporting arms. It normally collocates with the senior fire support coordination center within the ground combat element and is subordinate to the tactical air command center. Also call **DASC**. (Joint Pub 1-02)

dissemination – See **intelligence cycle**.

electronic reconnaissance – The detection identification, evaluation, and location of foreign electromagnetic radiations emanating from other than nuclear detonations or radioactive sources. (Joint Pub 1-02)

electronic warfare – Any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Also called **EW**. The three major subdivisions within electronic warfare are: electronic attack, electronic protection, and electronic warfare support. a. **electronic attack**. That division of electronic warfare involving the use of electromagnetic, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. Also called **EA**. EA includes: 1) actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum, such as jamming and electromagnetic deception, and 2) employment of weapons that use either electromagnetic or directed energy as their primary destructive mechanism (lasers, radio frequency weapons, particle beams). B. electronic protection. That division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy employment of electronic warfare that degrade, neutralize, or destroy friendly combat capability. Also called **EP**. c. **electronic warfare support**. That division of electronic warfare involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support provides information required for immediate decisions involving electronic warfare operations and other tactical actions such as threat avoidance, targeting, and homing. Also called **ES**. Electronic warfare support data can be used to produce signals intelligence, both communications intelligence, and electronics intelligence. (Joint Pub 1-02)

electro-optics – The technology associated with those components, devices and systems which are designed to interact between the electromagnetic (optical) and the electric (electronic) state. Also called **EO**. (Joint Pub 1-02)

emission control – The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities which minimizing, for operations security: a. detection by enemy sensors; b. minimize mutual interference among friendly systems; and/or c. execute a military deception plan. Also called **EMCON**. (Joint Pub 1-02)

forward arming and refueling point – A temporary facility, organized, equipped, and deployed by an aviation commander, and normally located in the main battle area closer to the area of operation that the aviation unit's combat service area, to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. The forward arming and refueling point permits combat aircraft to rapidly refuel and rearm simultaneously. Also called **FARP**. (Joint Pub 1-02)

forward looking infrared – An airborne, electro-optical thermal imaging device that detects far-infrared energy, converts the energy into an electronic signal, and provides a visible image for day or night viewing. Also called **FLIR**. (Joint Pub 1-02)

forward operating bases – An airfield used to support tactical operations without establishing full support facilities. The base may be used for an extended time period. Support by a main operating base will be required to provide backup support for a forward operating base. Also called **FOB**. (Joint Pub 1-02)

ground combat element – See **Marine air-ground task force**.

head-up display – A display of flight, navigation, attack, or other information superimposed upon the pilot's forward field of view. Also called **HUD**. (Joint Pub 1-02)

high-payoff target – A target whose loss to the enemy will significantly contribute to the success of the friendly course of action. High-payoff targets are those high-value targets, identified through wargaming, which must be acquired and successfully attacked for the success of the friendly commander's mission. Also called **HPT**. (Joint Pub 1-02)

high-value target – A target the enemy commander requires for the successful completion of the mission. The loss of high-value targets would be expected to seriously degrade important enemy functions throughout the friendly commander's area of interest. Also called **HVT**. (Joint Pub 1-02)

imagery exploitation – The cycle of processing and printing imagery to the positive or negative state, assembly into imagery packs, identification, interpretation, mensuration, information extraction, the preparation of reports, and the dissemination of information. (Joint Pub 1-02)

imagery – Collectively, the representations of objects reproduced electronically or by optical means on film, electronic display devices, or other media. (Joint Pub 1-02)

imagery intelligence – Intelligence derived from the exploitation of collection by visual photography, infrared sensors, lasers, electro-optics, and radar sensors such as synthetic aperture radar wherein images of objects are reproduced optically or electronically on film, electronic display devices, or other media. Also called **IMINT**. (Joint Pub 1-02)

information – 1. Facts, data, or instructions in any medium or form. 2. The meaning that a human assigns to data by means of the known conventions used in their representation. (Joint Pub 1-02)

infrared imagery – That imagery produced as a result of sensing electromagnetic radiations emitted or reflected from a given target surface in the infrared position of the electromagnetic spectrum (approximately 0.72 to 1,000 microns). (Joint Pub 1-02)

infrared linescan system – A passive airborne infrared recording system which scans across the ground beneath the flight path, adding successive lines to the record as the vehicle advances along the flight path. (Joint Pub 1-02)

infrared radiation – Radiation emitted or reflected in the infrared portion of the electromagnetic spectrum. (Joint Pub 1-02)

intelligence cycle – The steps by which information is converted into intelligence and made available to users. There are five steps in the cycle: a. **planning and direction** – Determination of intelligence requirements, preparation of a collection plan, issuance of orders and requests to information collection agencies, and a continuous check on the productivity of collection agencies. b. **collection** – Acquisition of information and the provision of this information and the provision of this information to processing and/or production elements. c. **processing** – Conversion of collected information into a form suitable to the production of intelligence. d. **production** – Conversion of information into intelligence through the integration, analysis, evaluation, and interpretation of all source data and the preparation of intelligence products in support of known or anticipated user requirements. e. **dissemination** – Conveyance of intelligence to users in a suitable form. (Joint Pub 1-02)

intelligence preparation of the battlespace – An analytical methodology employed to reduce uncertainties concerning the enemy, environment, and terrain for all types of operations. Intelligence preparation of the battlespace builds an extensive database for each potential area in which a unit may be required to operate. The database is then analyzed in detail to determine the impact of the enemy, environment, and terrain on operations and presents it in graphic form. Intelligence preparation of the battlespace is a continuing process. Also called **IPB**. (Joint Pub 1-02)

joint air operation center – A jointly staffed facility established for planning, directing, and executing joint air operations in support of the joint force commander's operation or campaign objectives. Also called **JAOC**. (Joint Pub (1-02)

joint force – A general term applied to a force composed of significant elements, assigned or attached, of two or more Military Departments, operating under a single joint force commander.

joint force air component commander – The joint force air component commander derives authority from the joint force commander who has the authority to exercise operational control, assign missions, direct coordination among subordinate commanders, redirect and organize forces to ensure unity of effort in the accomplishment of the overall mission. The joint force commander will normally designate a joint force air component commander. The joint fore air component commander's responsibilities will be assigned by the joint force commander (normally these would include, but not be limited to, planning, coordination, allocation, and tasking based on the joint force commander's apportionment decision). Using the joint force commander's guidance and authority, and in coordination with other Service component commanders and other assigned or supporting commanders, the joint force air component commander will recommend to the joint force commander apportionment of air sorties to various missions or geographic areas. Also called **JFACC**. (Joint Pub 1-02)

joint force commander – A general term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force. Also called **JFC**. (Joint Pub 1-02)

joint intelligence center – The intelligence center of the joint force headquarters. The joint intelligence center is responsible for providing and producing the intelligence required to support the joint force commander and staff, components, task forces and elements, and the national intelligence community. Also called **JIC**. (Joint Pub 1-02)

joint task force – A joint force that is constituted and so designated by the Secretary of Defense, a combatant commander, a sub-unified commander, or an existing joint task force commander. Also called **JTF**. (Joint Pub 1-02)

liaison – That contact or intercommunication maintained between elements of military forces or other agencies to ensure mutual understanding and unity of purpose and action. (Joint Pub 1-02)

Marine air command and control system – A system which provides the aviation combat element commander with the means to command, coordinate, and control all air operations within an assigned sector and to coordinated air operations with other Services. It is composed of command and control agencies with communications-electronics equipment that incorporates a capability from manual through semiautomatic control. Also called **MACCS**. (Joint Pub 1-02)

Marine air ground task force – A task organization of Marine forces (division, aircraft wing, and service support groups) under a single command and structured to accomplish a specific mission. The Marine air-ground task force (**MAGTF**) components will

normally include command, aviation combat, ground combat, and combat service support elements (including Navy Support Elements). Three types of Marine air-ground task forces which can be task organized are the Marine expeditionary unit, Marine expeditionary brigade, and the Marine expeditionary force. The four elements of a Marine air-ground task force are: a. **command element** – The MAGTF headquarters. The command element is a permanent organization composed of the commander, general or executive and special staff sections, headquarters section, and requisite communications and service support facilities. The command element provides command, control, and coordination essential for effective planning and execution of operations by the other three elements of the MAGTF. There is only one command element in a MAGTF. Also called **CE**. b. **aviation combat element** – The MAGTF element that is task organized to provide all or a portion of the functions of Marine Corps aviation in varying degrees based on the tactical situation and the MAGTF mission and size. These functions are air reconnaissance, antiair warfare, assault support, offensive air support, electronic warfare, and control of aircraft and missiles. The aviation combat element is organized around an aviation headquarters and varies in size from a reinforced helicopter squadron to one or more Marine aircraft wing(s). It includes those aviation command (including air control agencies), combat, combat support, and combat service support units required by the situation. Normally, there is only one aviation combat element in a MAGTF. Also called **ACE**. c. **ground combat element** – The MAGTF element that is task organized to conduct ground operations. The ground combat element is constructed around an infantry unit and varies in size from a reinforced infantry battalion to one or more reinforced Marine division(s). The ground combat element also includes appropriate combat support and combat service support units. Normally, there is only one ground combat element in a MAGTF. Also called **GCE**. d. **combat service support element** – The MAGTF element that is task organized to provide the full range of combat service support necessary to accomplish the MAGTF mission. The combat service support element can provide supply, maintenance, transportation, deliberate engineer, health, postal, disbursing, enemy prisoner of war, automated information systems, exchange, utilities, legal, and graves registration services. The combat service support element varies in size from a Marine expeditionary unit (MEU) service support group (MSSG) to a force service support group (FSSG). Normally, there is only one combat service support element in a MAGTF. Also called **CSSE**. (Joint Pub 1-02)

Marine aircraft group – The Marine aircraft group is usually administratively and tactically structured by aircraft category as being either a helicopter group or a fixed-wing group. Composite Marine aircraft groups may also be formed for specific missions or unique organizational/geographic considerations. Each Marine aircraft group has a headquarters and maintenance squadron. With a source of supply, the Marine aircraft group is the smallest aviation unit capable of self-sustaining independent operations. Also called **MAG**. (MCRP 5-12C)

Marine aircraft wing – The Marine aircraft wing is the highest level aviation command in the Fleet Marine Force. The Marine aircraft wing is task-organized to provide a flexible and balanced air combat organization capable of providing the full range of combat air operations in a variety of areas without the requirement of prepositioned

support, control, and logistic facilities. Only the wing has the inherent capability of performing all six aviation functions. Also called **MAW**. (MCRP 5-12C0

Marine air control group – A command that provides, operates, and maintains the Marine air command and control system, a battle-ready system of command and control agencies fully integrated by rapid, reliable tactical communications. With Stinger missile systems, and in conjunction with coordinating the equipment of interceptor aircraft and those ground-based systems, the Marine air control group provides low altitude air defense against low/medium altitude air attacks. Also called **MACG**. (MCRP 5-12C)

Marine air support squadron – The component of the Marine air control group which provides and operates facilities for the control of support aircraft operating in direct support of ground forces. Also called **MASS**. (Joint Pub 1-02)

Marine Corps planning process – A six step methodology which helps organize the though processes of the commander and staff throughout the planning and execution of military operations. If focuses on the threat and is based on the Marine Corps philosophy of maneuver warfare. It capitalizes on the principle of unity of command and supports the establishment and maintenance of tempo. The six steps consist of mission analysis, course of action development, course of action analysis, comparison/decision, orders development, and transition. Also called **MCPP**. **Note**: Tenets of the MCPP include top down planning, single battle concept, and integrated planning. (MCRP 5-12C)

multi-spectral imagery – The image of an object obtained simultaneously in a number of discrete spectral bands. (Joint Pub 1-02)

near real time – Pertaining to the timeliness of data or information which has been delayed by the time required for electronic communication and automatic data processing. This implies that there are no significant delays. Also called **NRT**. (Joint Pub 1-02)

oblique air photograph – An air photograph taken with the camera axis directed between the horizontal and vertical planes. Commonly referred to as an "oblique." a. High Oblique. One in which the apparent horizon appears. b. Low Oblique. One in which the apparent horizon does not appear. (Joint Pub 1-02)

operational control – Transferable command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant command (command authority). Operational control may be delegated and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinated organizations. Normally this authority is exercised through the

commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. Also called OPCON. (Joint Pub 1-02)

order of battle – The identification, strength, command structure, and disposition of the personnel, units, and equipment of any military force. (Joint Pub 1-02)

priority intelligence requirements – Those intelligence requirements for which a commander has an anticipated and stated priority in his task of planning and decisionmaking. (Joint Pub 1-02)

radar imagery – Imagery produced by the recording of radar waves reflected from a given target surface. (Joint Pub 1-02)

rules of engagement – Directives issued by competent military authority which delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered. Also called **ROE**. (Joint Pub 1-02)

sensor – An equipment which detects, and may indicate, and/or record objects and activities by means of energy or particles emitted, reflected, or modified by objects. (Joint Pub 1-02)

signals intelligence – 1. A category of intelligence comprising either individually or in combination all communications intelligence, electronics intelligence, and foreign instrumentation signals intelligence, however transmitted. 2. Intelligence derived from communications, electronics, and foreign instrumentation signals. Also called **SIGINT**. (Joint Pub 1-02)

situational awareness – Knowledge and understanding of the current situation which promotes timely, relevant, and accurate assessment of friendly, enemy, and other operations within the battlespace in order to facilitate decisionmaking. An informational perspective and skill that foster an ability to determine quickly the context and relevance of events that are unfolding. Also called **SA**. (MCRP 5-12C)

suppression of enemy air defenses – That activity which neutralizes, destroys, or temporarily degrades surface –based enemy air defenses by destructive and/or disruptive means. Also called **SEAD**. (Joint Pub 1-02)

surveillance – The systematic observation of aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. (Joint Pub 1-02)

tactical air command center – The principal US Marine Corps air command and control agency from which air operations and air defense warning functions are directed. It is the senior agency of the US Marine air command and control system which serves as the operational command post of the aviation combat element commander. It provides the facility from which the aviation combat element commander and his battle staff plan, supervise, coordinate, and execute all current and future air operations is support of the Marine air-ground task force. The tactical air command center can provide integration, coordination, and direction of joint and combined air operations. Also **called Marine TACC**. (Joint Pub 1-02)

tactical air direction center – An air operations installation under the overall control of the tactical air control center (afloat)/tactical air command center, from which aircraft and air warning service functions of tactical air operations in an area of responsibility as directed. Also called **TADC**. (Joint Pub 1-02)

tactical air operations center – The principal air control agency of the US Marine air command and control system responsible for airspace control and management. It provides real time surveillance, direction, positive control, and navigational assistance for friendly aircraft. It performs real time direction and control of all antiair warfare operations, into include manned interceptors and surface-to-air weapons. It is subordinate to the tactical air command center. Also called **TAOC**. (Joint Pub 1-02)

tactical air reconnaissance – The use of air vehicles to obtain information concerning terrain, weather, and the disposition, composition, movement, installations, lines of communications, electronic and communication emissions of enemy forces. Also included are artillery and naval gunfire adjustment, and systematic and random observation of ground battle areas, targets, and/or sectors of airspace. (Joint Pub 1-02)

time on station – The time that an aircraft can actually spend performing its assigned mission. If does not include the time transiting to and from the operating site. Also called **TOS**. (MCRP 5-12C)

unmanned aerial vehicle – A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles. Also called **UAV**. (Joint Pub 1-02)

vertical air photograph – An air photograph taken with the optical axis of the camera to the surface of the Earth. (Joint Pub 1-02)

visual reconnaissance – The use of visual observation to obtain information about the activities and resources of an enemy or the physical characteristics of a given area. Visual reconnaissance supplements operational information concerning friendly forces and aids offensive actions such as artillery, naval surface fire support, or air support missions. (MCRP 5-12C)

Appendix H

References and Related Publications

Joint Publications

0-2	Unified Action Armed Forces (UNAAF)
1-02	Department of Defense Dictionary of Military and Associated Terms
2-0	Doctrine for Intelligence Support to Joint Operations
2-01	Joint Intelligence Support to Military Operations
2-02	National Intelligence Support to Joint Operations
3-01.4	Joint Tactics, Techniques, and Procedures for Joint Suppression of Enemy Air Defenses (J-SEAD)
3-09	Doctrine for Joint Fire Support
3-51	Joint Doctrine for Electronic Warfare
3-52	Doctrine for Joint Airspace Control in the Combat Zone
3-55	Doctrine for Reconnaissance, Surveillance, and Target Acquisition Support for Joint Operations
3-55.1	Joint Tactics, Techniques, and Procedures for Unmanned Aerial Vehicles
3-56.1	Command and Control for Joint Air Operations

Marine Corps Doctrinal Publications (MCDP's)

2	Intelligence
3	Planning
4	Command and Control

Marine Corps Warfighting Publications (MCWP's)

0-1	Marine Corps Operations
2-1	Intelligence Operations
2-15.2	Signals Intelligence
2-15.4	Imagery Intelligence
3-25	Control of Aircraft and Missiles
3-25.3	Marine Air Command and Control System Handbook
3-25.4	Marine Tactical Air Command and Control Center Handbook
3-25.5	Direct Air Support Center Handbook
5-1	Marine Corps Planning Process
6-22	Communications and Information Systems

Marine Corps Reference Publications (MCRP's)

2-11A	Multiservice Procedures for Requesting Reconnaissance Information in a Joint Environment
3-22A	Multiservice Tactics, Techniques, and Procedures for the EA-6B Employment in the Joint Environment

Miscellaneous

MEF Planner's Reference Manual (MSPT Pamphlet 5-0.3)